User's Manual

Wave Rider 1

Central Lighting Inverter
3 – 20 kva (2.1 – 17 kw)

Doc #. 6002-1394
Revision J
Installation and
Operating Documentation

Due to continuous product improvement this document is subject to change without prior notice.

TABLE OF CONTENTS

SECTION		PAGE
REVISION HISTORY		**c**
PROPRIETARY		**d**
SECTION 1 – SAFETY		**1-1**
SECTION 2 – INSTALLATION		**2-1**
2.1	SITE PLANNING AND PREPARATION	2-1
	Illustration 2-1: 48" Cabinet Cable Access and Mounting	2-2
	Illustration 2-2: 68" Cabinet Cable Access and Mounting	2-3
	Illustration 2-3: Oversize Cabinet Cable Access and Mounting	2-4
2.2	EQUIPMENT UNPACKING	2-5
	Illustration 2-4: Fork lifting	2-5
2.3	UNIT INSTALLATION	2-6
	Illustration 2-5: Wave Rider 1 Customer's Connection Input Terminal Block	2-7
	Illustration 2-6: Customer's Connection Terminal Block for 120/208/240/277V Output	2-8
	Illustration 2-7: Customer's Connection Terminal Block for 208/240/277V Output	2-8
	Illustration 2-8: Customer Connections Same Input/Output Voltage, 120V Unit	2-9
	Illustration 2-9: Customer Connections Same Input/Output Voltage, 208V Unit	2-10
	Illustration 2-10: Customer Connections Same Input/Output Voltage, 240V Unit	2-11
	Illustration 2-11: Customer Connections Same Input/Output Voltage, 277V Unit	2-12
	Illustration 2-12: Customer Connections Output Connection w/Output XFMR, 120V	2-13
	Illustration 2-13: Customer Connections Output Connection w/Output XFMR, 208V	2-14
	Illustration 2-14: Customer Connections Output Connection w/Output XFMR, 240V	2-15
	Illustration 2-15: Customer Connections Output Connection w/Output XFMR, 277V	2-16
	Illustration 2-16: Customer Connections Dual Output Connection w/Output XFMR, 120/240V	2-17
	Illustration 2-17: Customer Connections Dual Output Connection w/Output XFMR, 120/208V	2-18
	Illustration 2-18: Customer Connections Dual Output Connection w/Output XFMR, 120/277V	2-19
	Illustration 2-19: Customer Connections Battery Connections	2-20
2.4	REMOTE SIGNALLING CONNECTIONS (OPTIONAL)	2-20
2.5	BATTERY STORAGE	2-21
SECTION 3 – GENERAL		**3-1**
3.1	INTRODUCTION	3-1
	Illustration 3-1 Wave Rider 1	3-1
3.2	BENEFITS	3-2
3.3	PRODUCT FEATURES	3-3
	Illustration 3-2: Unit Component Layout	3-4
3.4	FUNCTIONAL DESCRIPTIONS	3-5
	Illustration 3-3: Functional Block Diagram	3-7
3.5	THEORY OF OPERATION	3-8
3.6	OUTPUT LOADS	3-9
3.7	OPTIONS (See more detail on Section 5)	3-9
SECTION 4 – OPERATION		**4-1**
4.1	START-UP PROCEDURES	4-1
4-2	OPERATION	4-3
4.3	FIELD REPLACEABLE UNITS	4-3
	Illustration 4-1: Heat Sink Assembly (FRU)	4-4
4.4	RENEWAL PARTS	4-5

SECTION		PAGE
SECTION 5 – SYSTEM OPTIONS		**5-1**
5.1	OPTIONAL EXTERNAL MANUAL BYPASS SWITCH	5-2
	Illustration 5-1: Manual Bypass Switch	5-2
	Illustration 5-2: Manual Bypass Switch Diagram	5-3
5.2	OPTIONAL INTERNAL MANUAL BYPASS SWITCH	5-4
5.3	OPTIONAL AUDIO ALARM WITH SILENCE SWITCH	5-4
5.4	OPTIONAL REMOTE UNIT STATUS PANEL – P/N 9100-1020-06	5-5
	Illustration 5-3: Remote Status Panel	5-5
5.5	OPTIONAL FORM “C” CONTACTS FOR ALARMS – P/N 9100-1362-01	5-6
5.6	OPTIONAL TVSS – P/N 9100-1440-02	5-6
5.7	OPTIONAL NORMALLY ON / NORMALLY OFF OUTPUT AUX. CIRCUIT BREAKERS – P/N 9100-1343-01 THRU –16	5-7
5.8	OPTIONAL EXTERNAL OUTPUT AUX. CB’S IN PANEL BOARD – P/N 9100-1439-01 THRU –03	5-7
5.9	OPTIONAL HIGHER KAIC NORM ON/OFF OUTPUT CB	5-7
5.10	OPTIONAL INPUT CB STANDARD / HIGHER KAIC	5-7
5.11	OPTIONAL OUTPUT CB STANDARD / HIGHER KAIC	5-8
5.12	OPTIONAL SEISMIC MOUNTING BRACKET – P/N 9100-1317-02	5-8
5.13	OPTIONAL STACKABLE CABINET RACK - P/N9100-1429-XX	5-8
5.14	OPTIONAL POWER FLOW MIMIC – P/N 9100-1493-01	5-8
	Illustration 5-4: Power Flow Mimic	5-8
5.15	OPTIONAL GLOBAL MONITORING SYSTEM, Local on UPS	5-9
5.15.1	Local On UPS - Event Log – P/N 9100-1466-01/9100-1538-XX	5-9
	Illustration 5-5: Logged Events	5-9
	Illustration 5-6: Status Screen	5-9
	Illustration 5-7: System Info	5-10
5.15.2	Local On UPS - AUX CBs Trip Monitor with Event Log – P/N 9100-1453-01	5-10
	Illustration 5-8: Auxiliary CB Trip	5-10
5.15.3	Local on PC via RS 232	5-11
	Illustration 5-9: Sample PC Screen	5-11
5.15.4	Local on PC via RS 485	5-11
5.16	OPTIONAL ECC – Emergency Circuit Converter	5-12
	Illustration 5-10: ECC Emergency Circuit Converter	5-12
5.17	OPTIONAL ECM – Emergency Control Module	5-13
	Illustration 5-11: ECM Emergency Control Module	5-13
SECTION 6 – MAINTENANCE		**6-1**
6.1	SAFETY PRECAUTIONS	6-1
6.2	WHEN TO CALL	6-3
6.3	STEPS TO TAKE	6-3
6.4	PREVENTIVE MAINTENANCE	6-3
6.5	CRUCIAL POWER CUSTOMER SERVICE AND SUPPORT	6-7
APPENDICES		
	APPENDIX A – SPECIFICATIONS	A-1
	APPENDIX B - LCD DISPLAY MENU & TROUBLESHOOTING GUIDE	B-1
	APPENDIX C – OPTIONAL MAIN INPUT/OUTPUT BREAKERS FOR VARIOUS MODELS	C-1
	APPENDIX D - BATTERY CONNECTIONS	D-1
	APPENDIX E – DRAWINGS & TABLES, REQUEST FOR TURN ON	E-1
	APPENDIX F – CONNECTION DIAGRAM FOR EXISTING 3 POLE PANELBOARD	F-1

Crucial Power Products, Inc.
Reproduction or Distribution forbidden

NOTICE: THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION

This document contains proprietary and confidential information of Crucial Power Products, Inc. (”Crucial Power”). In consideration of the receipt of this document, the recipient agrees not to copy any of its contents, nor to disclose them to or allow them to be used by any person not currently an Crucial Power employee or an employee of the recipient having a need to know, without the express written consent of Crucial Power, and further agrees to surrender this document to Crucial Power when the reason for its receipt has terminated.

© 2009 Crucial Power Products, Inc. – All rights reserved

Crucial Power Products

Congratulations on selecting one of the fine products from Crucial Power, the leader in power protection technology. Our wide product offering includes UPS (**U**ninterruptible **P**ower **S**ystems), power conditioners, automatic voltage regulators and specialty transformers (e.g., computer-grade, medical-grade). Since our founding in 1972, Crucial Power has shipped many of these fine products to discerning customers around the world for use on sensitive equipment and critical applications.

One of our goals is to make our manuals both comprehensive and easy to use. The new format of our user manual is the result of ideas and inputs from customers like you who have taken an active interest in our continued success. We invite and appreciate your feedback on our products and documentation via e-mail, fax, mail, or telephone.

SALES

Phone: (800) 244-4069
FAX No: (800) 246-2346
E-mail: info@crucialpower.com

Office Hours are 7:00 AM to 5:30 PM PST

WARRANTY REGISTRATION AND WARRANTY CERTIFICATE REQUEST
www.800pwrsrvc.com

SERVICE

If you require assistance, please call our 24-hour toll free hot line **800-PWR-SRVC** (800-797-7782). Please have the following information from your unit's nameplate available to speed assistance:

Serial Number: _____

kVA/Power Rating: _____

Input Voltage: _____

Output Voltage: _____

Manufacturer Date: _____

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

SECTION 1 - SAFETY

Following safety precautions is important when operating or servicing electrical equipment. The symbols shown are used extensively throughout this manual. Always heed these precautions since they are essential to the safe operation and servicing of this product.

Boxes labeled with the "**Danger!"** symbol indicate that there is a high risk of personal injury or death if instructions are not followed.

Warnings labeled with the **Caution** symbol indicate that there is a high probability of equipment failure, damage, or destruction if instructions are not followed.

Danger!

ONLY FACTORY TRAINED OR AUTHORIZED PERSONNEL SHOULD ATTEMPT TO INSTALL OR REPAIR THE UNIT OR ITS BATTERY SYSTEM. IMPROPER INSTALLATION HAS PROVEN TO BE THE SINGLE MOST SIGNIFICANT CAUSE OF START-UP PROBLEMS. HIGH AC AND DC ELECTRICAL VOLTAGES ARE PRESENT THROUGHOUT THE UNIT(S) AND INCORRECT INSTALLATION OR SERVICING COULD RESULT IN ELECTROCUTION, FIRE, EXPLOSION, OR EQUIPMENT FAILURE.

Danger!

READ THIS MANUAL IN ITS ENTIRETY BEFORE PERFORMING THE INSTALLATION, START-UP, OPERATION, OR MAINTENANCE OF THE UNIT (Uninterruptible **P**ower **S**ystem**) OR BATTERY SYSTEMS. FAILURE TO DO SO COULD RESULT IN ELECTROCUTION, FIRE, EXPLOSION, OR EQUIPMENT FAILURE.**

If you require assistance, call toll free 800-PWR-SRVC (800-797-7782). Please have the following information from your unit's nameplate available to speed assistance:

Serial Number: _____

kVA/Power Rating: _____

Input Voltage: _____

Output Voltage: _____

Manufacturer Date: _____

Danger!

ALL POWER CONNECTIONS MUST BE COMPLETED BY A LICENSED ELECTRICIAN WHO IS EXPERIENCED IN WIRING THIS TYPE OF EQUIPMENT. WIRING MUST BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES. IMPROPER WIRING MAY CAUSE DAMAGE TO THE EQUIPMENTS, INJURY OR DEATH OF PERSONNEL. VERIFY THAT ALL HIGH AND LOW VOLTAGE INPUT POWER CIRCUITS ARE DE-ENERGIZED AND LOCKED OUT BEFORE INSTALLING CABLES OR MAKING ANY ELECTRICAL CONNECTIONS.

Danger!

EXERCISE EXTREME CARE WHEN HANDLING UNIT AND BATTERY CABINETS TO AVOID EQUIPMENT DAMAGE OR INJURY TO PERSONNEL. CABINETS WEIGH SEVERAL HUNDRED POUNDS.

Danger!

TEST LIFT AND BALANCE THE CABINETS BEFORE MOVING. MAINTAIN MINIMUM TILT FROM VERTICAL AT ALL TIMES. THE BOTTOM STRUCTURE WILL SUPPORT THE UNIT ONLY IF THE FORKLIFT FORKS ARE COMPLETELY UNDERNEATH THE UNIT.

Danger!

OBSERVE ALL BATTERY SAFETY PRECAUTIONS DURING INSTALLATION OR SERVICE OF THE UNIT OR BATTERIES. EVEN WITH THE BATTERY CIRCUIT BREAKER IN THE OFF POSITION, THE DANGER OF ELECTROCUTION MAY STILL BE PRESENT. THE BATTERY POWER TO THE UNIT MUST BE LOCKED AND TAGGED "OFF" BEFORE PERFORMING ANY SERVICE OR WORK ON THE UNIT. THE BATTERY MANUFACTURER'S SAFETY INFORMATION AND MATERIAL SAFETY DATA SHEET IS LOCATED IN A POCKET ATTACHED TO THE INSIDE OF LEFT DOOR OF EACH UNIT. FAILURE TO FOLLOW THOSE INSTRUCTIONS AND THE INSTRUCTION LISTED ABOVE AND ELSEWHERE IN THIS MANUAL COULD RESULT IN AN EXPLOSION, FIRE, EQUIPMENT FAILURE, OR ELECTROCUTION.

Danger!

ALL POWER TO THE UNIT MUST BE LOCKED AND TAGGED "OFF" BEFORE PERFORMING ANY SERVICE OR WORK ON THE UNIT. FAILURE TO DO SO COULD RESULT IN ELECTROCUTION.

Danger!

IN CASE OF FIRE INVOLVING ELECTRICAL EQUIPMENT. ONLY CARBON DIOXIDE FIRE EXTINGUISHERS, OR THOSE APPROVED FOR USE ON ELECTRICAL EQUIPMENT, SHOULD BE USED. USE OF WATER ON FIRES INVOLVING LIVE HIGH VOLTAGE ELECTRICAL CIRCUITS COULD PRESENT AN ELECTROCUTION HAZARD.

Danger!

EXTREME CAUTION IS REQUIRED WHEN PERFORMING MAINTENANCE. LETHAL VOLTAGES EXIST WITHIN THE EQUIPMENT DURING OPERATION. OBSERVE ALL WARNINGS AND CAUTIONS IN THIS MANUAL. FAILURE TO COMPLY MAY RESULT IN SERIOUS INJURY OR DEATH. OBTAIN QUALIFIED SERVICE FOR THIS EQUIPMENT AS INSTRUCTED.

Danger!

BE CONSTANTLY AWARE THAT THE UNIT SYSTEM CONTAINS HIGH DC AS WELL AS AC VOLTAGES. WITH INPUT POWER OFF AND THE BATTERY, DISCONNECTED, HIGH VOLTAGE AT THE FILTER CAPACITORS AND POWER CIRCUITS SHOULD DISCHARGE WITHIN 30 SECONDS. HOWEVER, POWER CIRCUIT FAILURES CAN OCCUR, SO YOU SHOULD ALWAYS ASSUME THAT HIGH VOLTAGE MIGHT STILL EXIST AFTER SHUTDOWN. VERIFY THAT POWER IS OFF USING AC AND DC VOLTMETERS BEFORE MAKING CONTACT.

Danger!

SOME COMPONENTS WITHIN THE CABINETS ARE NOT CONNECTED TO CHASSIS GROUND. ANY CONTACT BETWEEN FLOATING CIRCUITS AND THE CHASSIS IS A LETHAL SHOCK HAZARD.

Danger!

INTERNAL BATTERY STRAPPING MUST BE VERIFIED BY THE CUSTOMER PRIOR TO MOVING THIS UNIT.

THIS UNIT CONTAINS NON-SPILLABLE BATTERIES. KEEP THE UNIT UPRIGHT. DO NOT STACK. DO NOT TIP. ALWAYS FOLLOW THE BATTERY MANUFACTURER'S SAFETY INFORMATION LOCATED IN A POCKET ATTACHED TO THE INSIDE OF THE LEFT DOOR OF YOUR UNIT TO PREVENT AN ACCIDENT THAT COULD RESULT IN INJURY OR DEATH.

Danger!

LEAD-ACID BATTERIES CONTAIN HAZARDOUS MATERIALS. BATTERIES MUST BE HANDLED, TRANSPORTED, AND RECYCLED OR DISCARDED IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS. BECAUSE LEAD IS A TOXIC SUBSTANCE, LEAD-ACID BATTERIES SHOULD BE RECYCLED RATHER THAN DISCARDED.

DO NOT DISPOSE OF BATTERIES IN A FIRE, THE BATTERIES MAY EXPLODE.

DO NOT OPEN OR MUTILATE THE BATTERIES. RELEASED ELECTROLYTE IS HARMFUL TO THE SKIN AND EYES AND MAY BE TOXIC.

A BATTERY CAN HAVE A HIGH SHORT CIRCUIT CURRENT AND PRESENT A RISK OF ELECTRICAL SHOCK. THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED WHEN WORKING ON BATTERIES:

1. **REMOVE WATCHES, RINGS OR OTHER METAL OBJECTS.**
2. **USE TOOLS WITH INSULATED HANDLES.**
3. **WEAR RUBBER GLOVES AND BOOTS.**
4. **DO NOT LAY TOOLS OR METAL PARTS ON TOP OF BATTERIES.**
5. **DISCONNECT CHARGING SOURCE PRIOR TO CONNECTING OR DISCONNECTING BATTERY TERMINALS.**
6. **DETERMINE IF BATTERY IS INADVERTENTLY GROUNDED. IF SO, REMOVE THE SOURCE OF THE GROUND. CONTACT WITH ANY PART OF A GROUNDED BATTERY CAN RESULT IN ELECTRICAL SHOCK. THE LIKELIHOOD OF SUCH SHOCK WILL BE REDUCED IF SUCH GROUNDS ARE REMOVED DURING INSTALLATION AND MAINTENANCE.**
7. **LEAD-ACID BATTERIES CAN PRESENT A RISK OF FIRE BECAUSE THEY GENERATE HYDROGEN GAS. THE FOLLOWING PROCEDURES SHOULD BE FOLLOWED:**
   1. **DO NOT SMOKE WHEN NEAR BATTERIES.**
   2. **DO NOT CAUSE FLAME OR SPARK IN BATTERY AREA.**
8. **DISCHARGE STATIC ELECTRICITY FROM YOUR BODY BEFORE TOUCHING BATTERIES BY FIRST TOUCHING A GROUNDED SURFACE.**

SECTION 2 – INSTALLATION

2.1 SITE PLANNING AND PREPARATION

The Wave Rider 1 is designed for installation indoors and meets NEMA specifications for operating temperature, humidity, and utility voltage. These cabinets are rugged and corrosion resistant. The footprint of the Wave Rider 1 is less than 6 square feet. Listed below are the environmental specifications for the Wave Rider 1. Adequate clearance in the front of the equipment **MUST** be provided for service access.

2.1.1 Operating Environment

AMBIENT TEMPERATURE	0° to 40°C (32 to 104°F)
OPERATING ALTITUDE	1,829 M (6,000 FT) DERATE 10% FOR EACH ADDITIONAL 305 M (1,000 FT) UP TO 2,744 m (9,000 FT)
RELATIVE HUMIDITY	0% to 95% (non-condensing)

Operating the Wave Rider 1 and batteries at either extreme of the temperature range may affect the long-term reliability of the system. This is especially true of the sealed, maintenance-free batteries. Sealed, maintenance-free batteries are designed to operate at normal room temperatures (72 to 77°F).

2.1.2 Storage Environment

Provide a storage environment which meets the following conditions:

AMBIENT TEMPERATURE	-20°C to 68°C (-4 to 154°F)
RELATIVE HUMIDITY	0% to 95% non-condensing
NOTE	System should be stored in its original packaging

2.1.3 Location Considerations

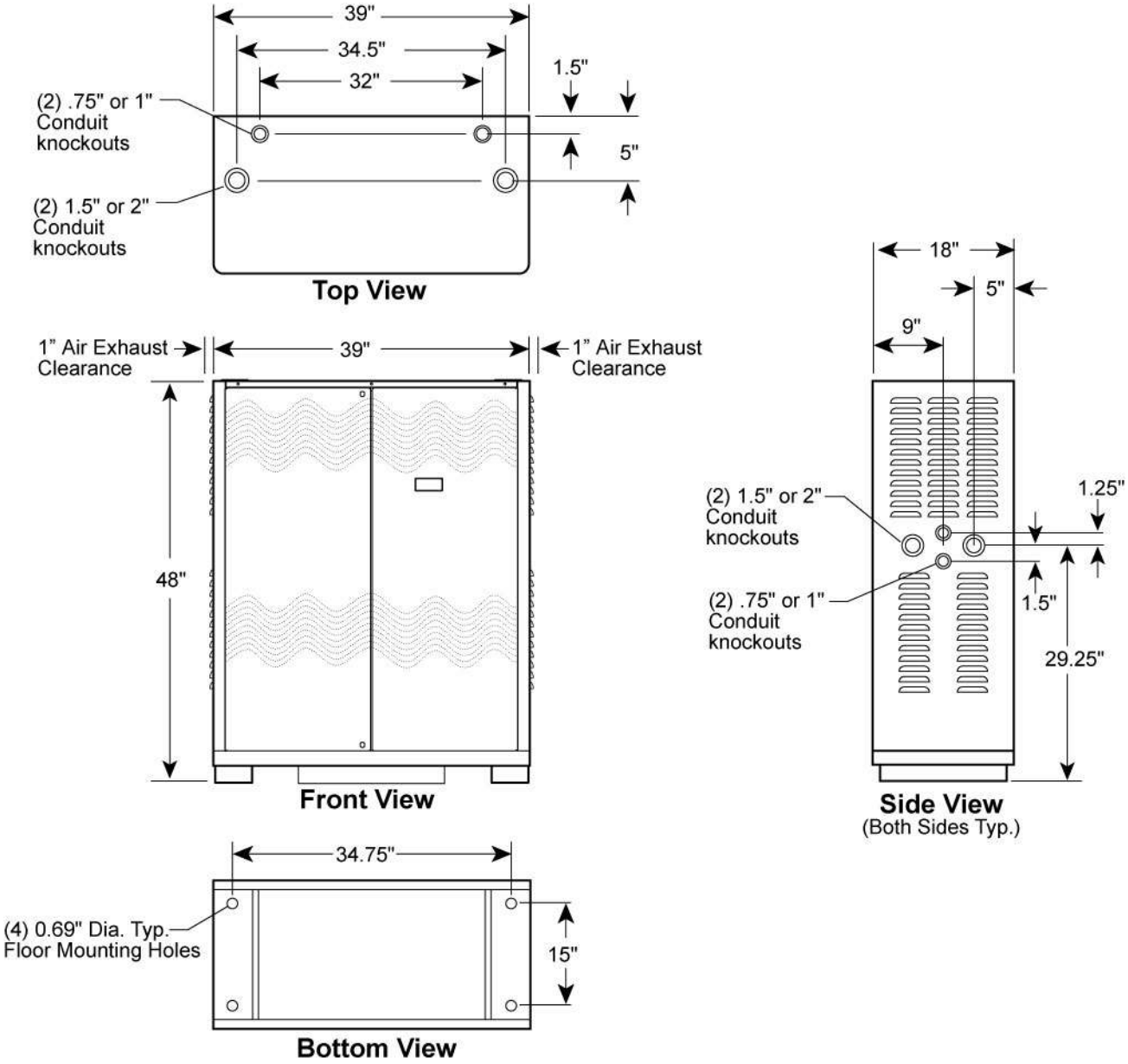


ILLUSTRATION 2-1: 48" CABINET CABLE ACCESS AND MOUNTING (3 KW)

2.1.4 Cable Access

Caution **Blocking vents may cause equipment malfunction and failure.**

The Wave Rider 1 Cabinet Installation Diagrams for 3~20 KVA models provide cable/conduit openings on the top and sides of the cabinet. Refer to Illustration 2-1, 2-2, and 2-3.

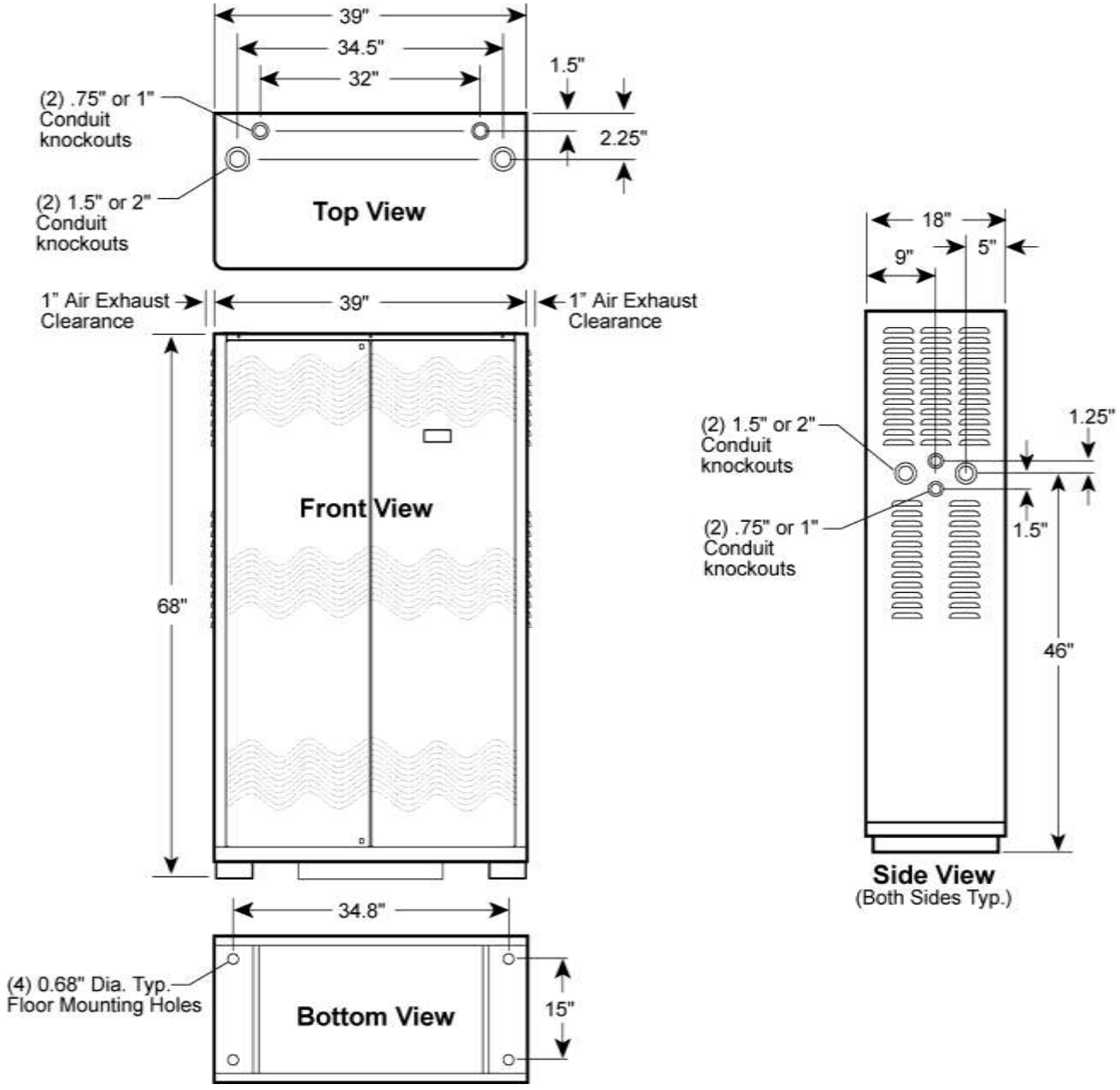
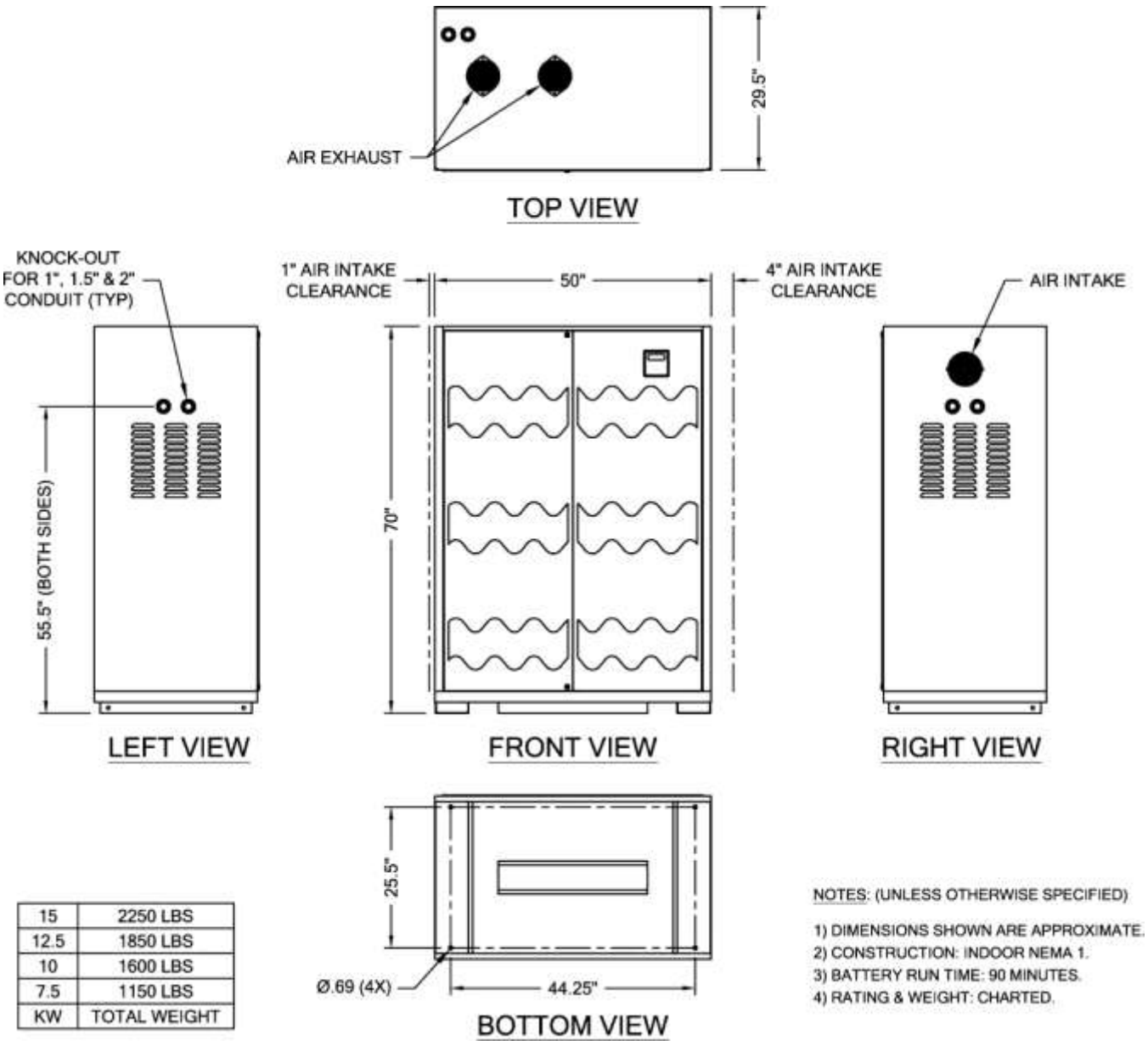


ILLUSTRATION 2-2: 68” CABINET CABLE ACCESS AND MOUNTING



15	2250 LBS
12.5	1850 LBS
10	1600 LBS
7.5	1150 LBS
KW	TOTAL WEIGHT

ILLUSTRATION 2-3: OVERSIZE CABINET CABLE ACCESS AND MOUNTING (7.5 – 15 KW WITH BATTERY)

Caution

Each model of the Wave Rider 1 is designed to supply a maximum load which is determined by its kVA (1000's of volt-amperes) and kW rating. It is very important that the load is within the rating of this Wave Rider 1 to ensure that the connected loads will be properly supported.
Each electrical device to be powered by the Wave Rider 1 should have a specification sheet attached to it, which specifies the amount of power it requires. In addition, this information should be listed in the manual supplied with each piece of equipment. The device's nameplate should also list the electrical requirements of the device.
The total load to be powered by the Wave Rider 1 must not exceed its kVA rating. If the total load is exceeded, the Wave Rider 1 monitoring will sense an overload condition and a summary alarm will occur.

2.1.5 Pre-Installation

All customer connections are brought through knockouts located on the top or on the sides of the unit. The Wave Rider 1 consists of one electronics and one or more battery cabinets. Before unpacking the equipment, inspect the exterior, the shipping container, and the equipment itself for damage that may have occurred during transit. If the shipping container or equipment itself shows evidence of damage, note the damage on the receiving document before signing for receipt of the equipment. Damage claims should be filed directly with the carrier.

2.2 EQUIPMENT UNPACKING

Danger!

EXERCISE EXTREME CARE WHEN HANDLING UPS AND BATTERY CABINETS TO AVOID EQUIPMENT DAMAGE OR INJURY TO PERSONNEL. CABINETS WEIGH SEVERAL HUNDRED POUNDS. TEST LIFT AND BALANCE THE CABINETS BEFORE MOVING. MAINTAIN MINIMUM TILT FROM VERTICAL AT ALL TIMES. THE BOTTOM STRUCTURE WILL SUPPORT THE UNIT ONLY IF THE FORKLIFT FORKS ARE COMPLETELY UNDERNEATH THE UNIT.

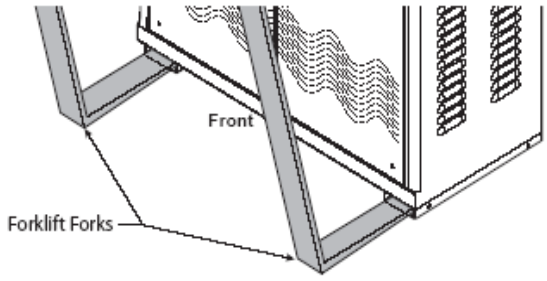


ILLUSTRATION 2-4: FORKLIFTING

Remove the equipment from the shipping carton. Since the Wave Rider 1 is designed for pad-mounting installations, there are no casters. It is suggested that a forklift be used to remove the Wave Rider 1 from its shipping pallet. See Illustration 2-4 for the location of forklift slot.

2.3 UNIT INSTALLATION

2.3.1 Mechanical Installation - Preparing to Install Unit

1) Before placing the Wave Rider 1 onto the mounting bolts (where it will be installed), the conduit knockouts need to be removed. The conduit knockouts are located on the sides and top of the cabinet. (See illustration 2-1, 2-2, and 2-3) **NOTE: If site restrictions prevent routing of conduit to the locations where conduit knockouts are located, do not drill holes in the cabinet without first consulting Crucial Power at 800-PWR-SRVC (800-797-7782). The conduit knockouts provided are positioned to prevent airflow disruptions that could cause the unit to overheat. Our engineers will be happy in assisting you in locating the conduit to maintain unit reliability.**
2) Determine which knockouts will be used to bring cables into and out of the unit. Only remove the conduit knockouts that are to be used.
3) Measure the locations for the conduits on the conduit knockouts.
4) Punch holes in the conduit knockouts for the conduits.
5) Anchor the Wave Rider 1 to the mounting pad at the four (4) mounting locations.
6) Anchor the conduits to the conduit knockouts

If equipment is not ready for normal operation, it must be protected from dust to prevent damage to equipment. This concludes the mechanical installation.

2.3.2 Electrical Connection Arrangements

Danger!

VERIFY THAT ALL CUSTOMER-SUPPLIED WIRING IS DE-ENERGIZED BEFORE PERFORMING ANY ELECTRICAL WORK. FAILURE TO DO SO COULD RESULT IN ELECTROCUTION, INJURY OR DAMAGE TO EQUIPMENT.

Danger!

EVEN WHEN THE WAVE RIDER 1 IS OFF, THERE ARE POTENTIALLY DANGEROUS VOLTAGES WITHIN THE WAVE RIDER 1 UNIT DUE TO THE BATTERIES. EXTREME CARE MUST BE TAKEN WHEN WORKING WITHIN THE WAVE RIDER 1 ENCLOSURE TO AVOID THE POSSIBILITY OF ELECTROCUTION, INJURY OR DAMAGE TO THE EQUIPMENT.

2.3.3 Customer Connections

A. Input Power Connection by Customer

Connect input (Hot) at TB-1

Connect input Hot/Neutral at TB1-2

Connect input ground at TB1-3

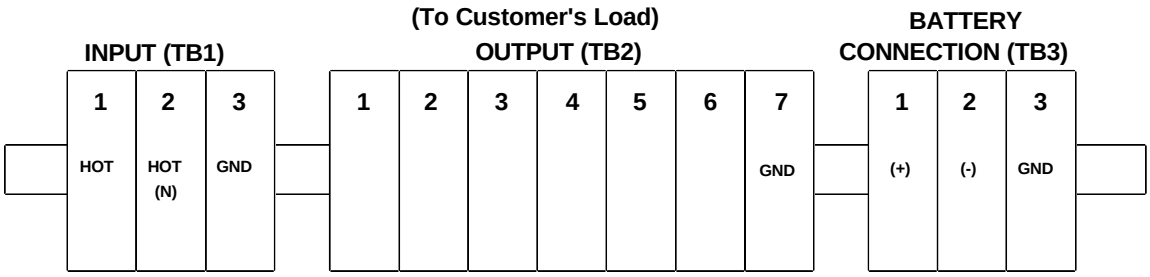


ILLUSTRATION 2-5: WAVE RIDER 1 CUSTOMER'S CONNECTION INPUT TERMINAL BLOCK

INPUT POWER			
VOLT	TERMINAL		
	1	2	3
120	H	N	GND
208	H	H	GND
240	H	H	GND
277	H	N	GND

B. Output Load Connection by Customer

Connect the critical load to one output terminal TB2 as shown in the voltage connection diagram with the main output circuit breaker.

However, when any aux. output CBs are used, follow the instructions below.

(1) No main output CB but only aux. output CBs are used.
Connect critical loads to aux CBs directly, [not TB2 – Do Not Use].

(2) Both main output CB and aux output CBs are used.
Connect the main load to TB2 as shown in the voltage connection diagram and connect other aux load directly to aux output CBs.
Locate the aux output CBs. Neutral and grounding terminals are provided.

For 120/208/240/277V output, verify jumper between TB2-2 and TB2-3.

120V output is connected at TB2-1 (Neutral) - TB2-2 (120VAC, Hot)

208V output is connected at TB2-1 (Hot), TB2-4 (208VAC, Hot)

240V output is connected at TB2-1 (Hot), TB2-5 (240VAC, Hot)

277V output is connected at TB2-1 (Neutral), TB2-6 (277VAC, Hot)

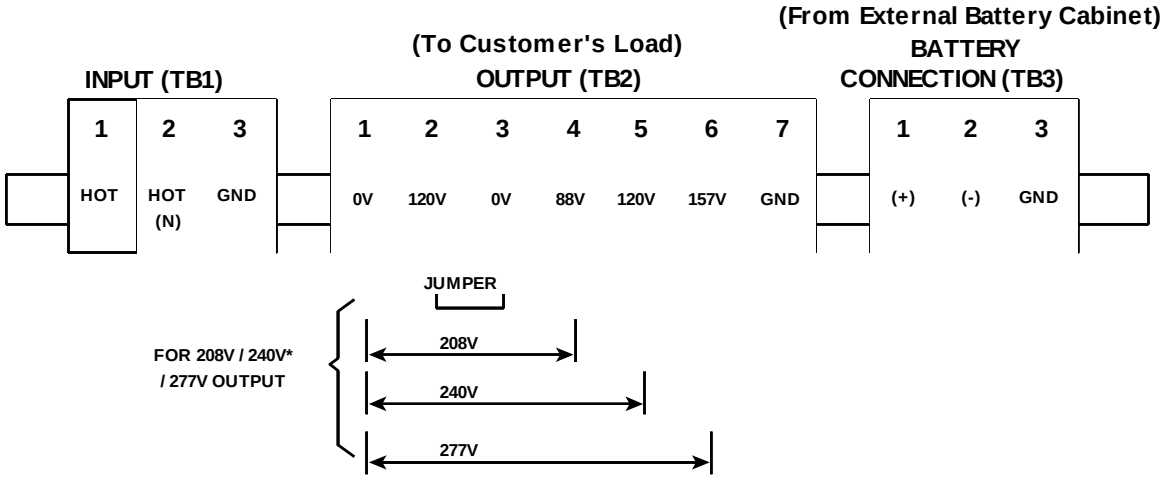


ILLUSTRATION 2-6: CUSTOMER'S CONNECTION OUTPUT TERMINAL BLOCK (120/208/240/277V)

For 208V/240/277V output

INPUT POWER				OUTPUT POWER			
VOLT	TERMINAL			VOLT	TB2- TERMINAL NO.	NEUTRAL BUS. MOVE TO	GND. BUS. MOVE TO
	1	2	3				
120	H	N	GND	120/240	1 TO 2 (120 V) 2 TO 5 (120 V)	TB2-2	TB2-3
208	H	H	GND	208	1 TO 4		7
240	H	H	GND	240	1 TO 5		7
277	H	N	GND	277	1 TO 6	TB2-1	TB2-1
				120	1 TO 2	TB2-1	TB2-1

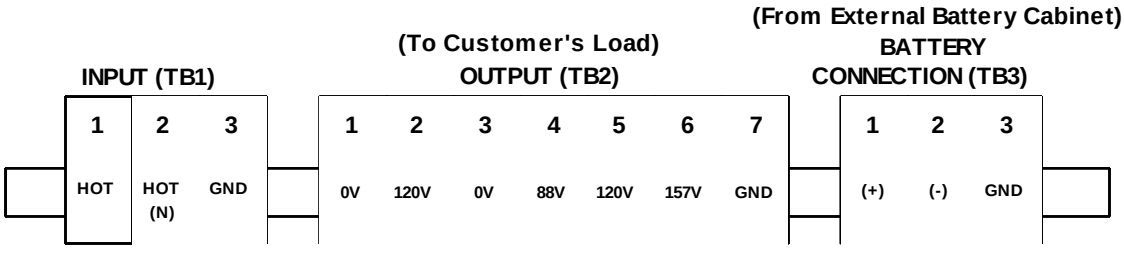


ILLUSTRATION 2-7: CUSTOMER'S CONNECTION OUTPUT TERMINAL BLOCK (120/208/240/277V)

If there are no requirements for remote signaling, section 2.4 may be skipped.

(2) Same input voltage and output voltage unit

(A) 120V Unit

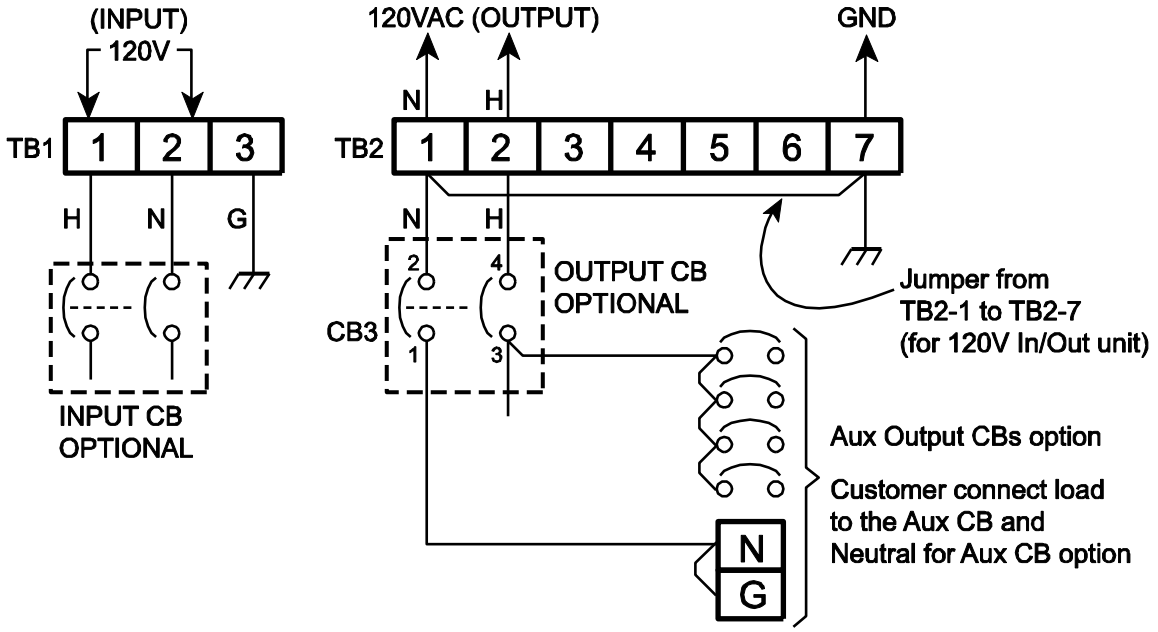


ILLUSTRATION 2-8: 120V UNIT

(2) continued

(B) 208V Unit

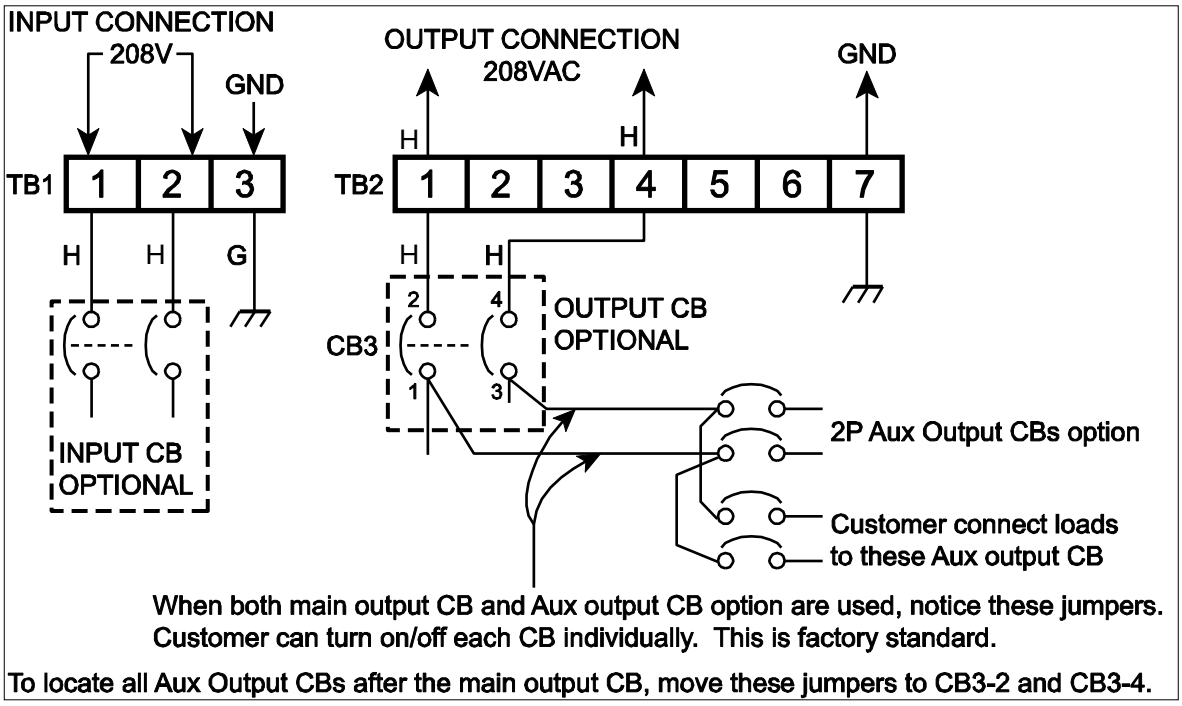
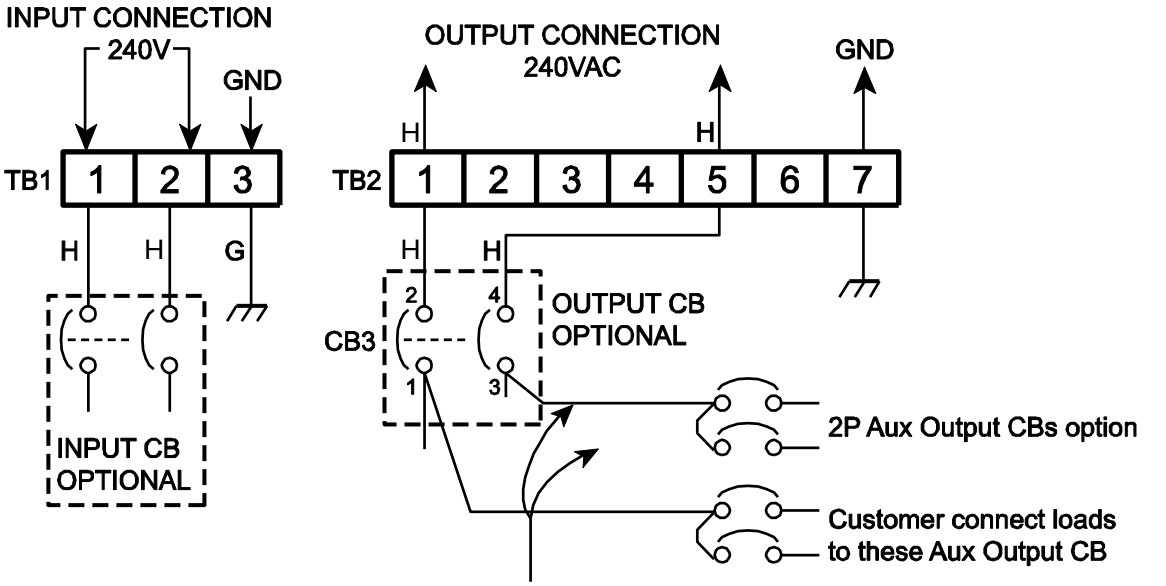


ILLUSTRATION 2-9: 208V UNIT

(2) continued

(C) 240V Unit



When both main output CB and Aux output CB option are used, notice these jumpers. Customer can turn on/off each CB individually. This is factory standard.

To locate all Aux Output CBs after the main output CB, move these jumpers to CB3-2 and CB3-4.

ILLUSTRATION 2-10: 240V UNIT

(2) continued

(D) 277V Unit

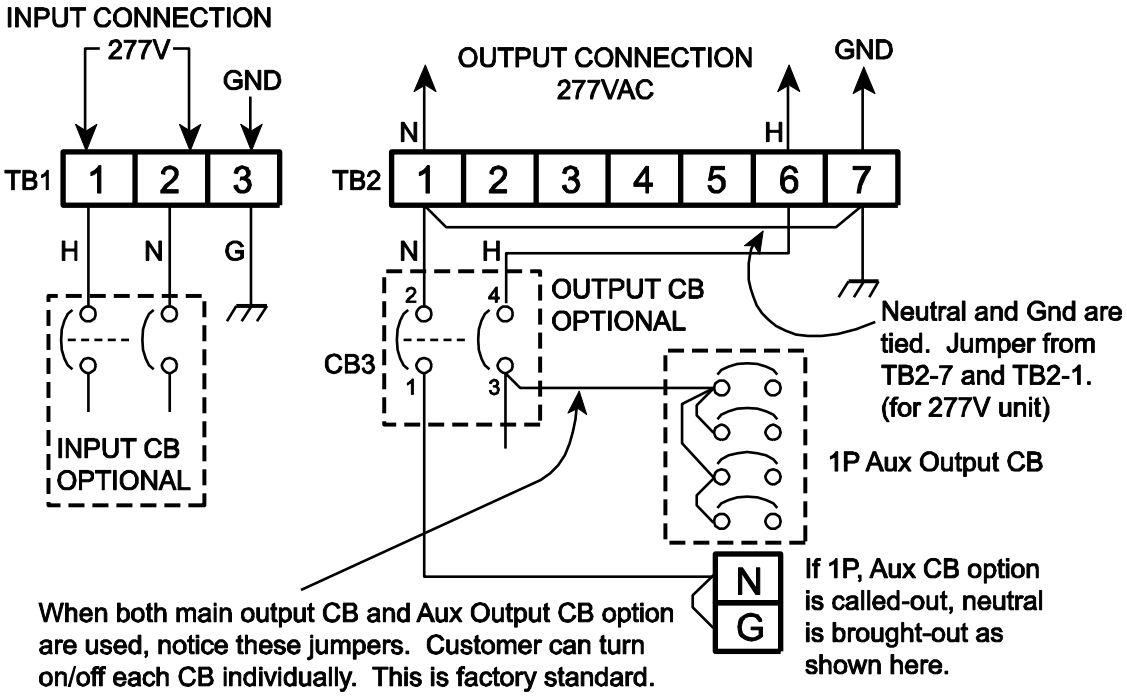


ILLUSTRATION 2-11: 277V UNIT

(3) Customer Connection
Output connection with output transformer

The following Illustrations 2-12 to 2-18 are standard Aux CB / Output CB's connections. (Note): When desire to locate all Aux Output CBs after the main output CB, move Aux CB wiring to CB3-2, & CB3-4.

For multiple output unit and different input/output voltage application.
There is an output transformer.

Input power connections are same as (I) refer to each voltage (I) – (A), (B), (C),)(D).

(A) 120V Output connection

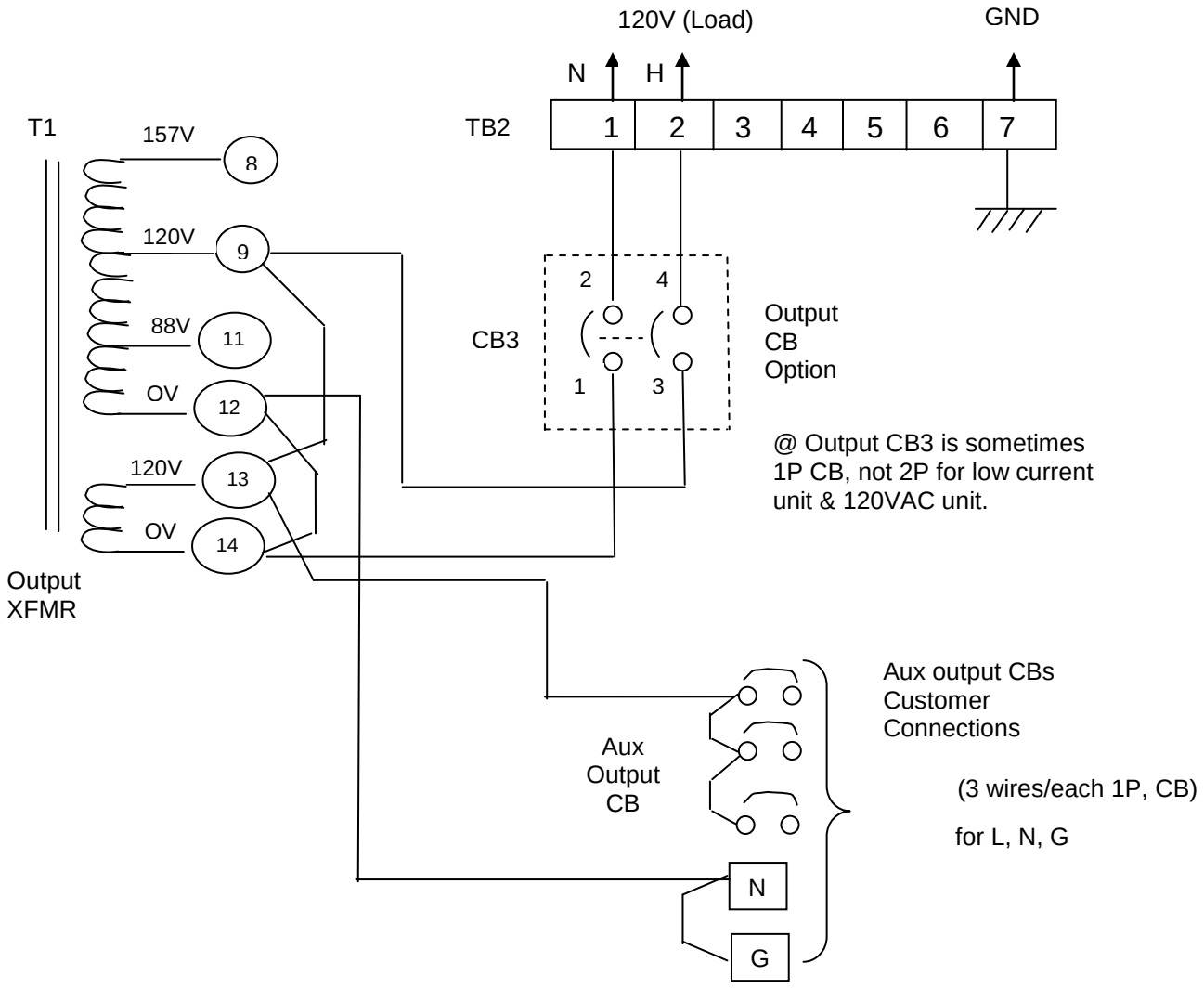


ILLUSTRATION 2-12: 120V Output Customer Connections w/ Output XFMR

(3) continued

(B) 208V Output connection

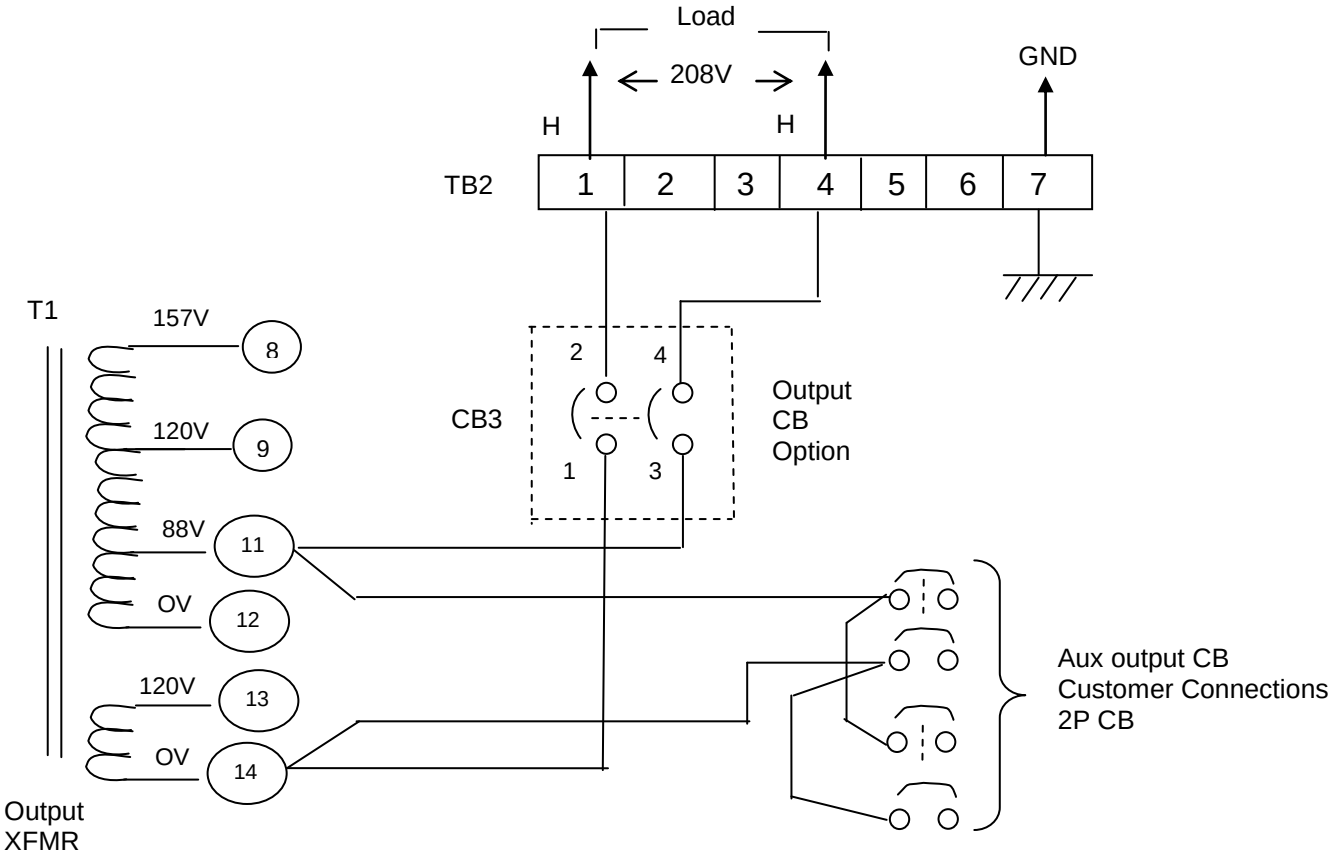


ILLUSTRATION 2-13: 208V Output Customer Connections w/ Output XFMR

(3) continued

(C) 240V Output connection

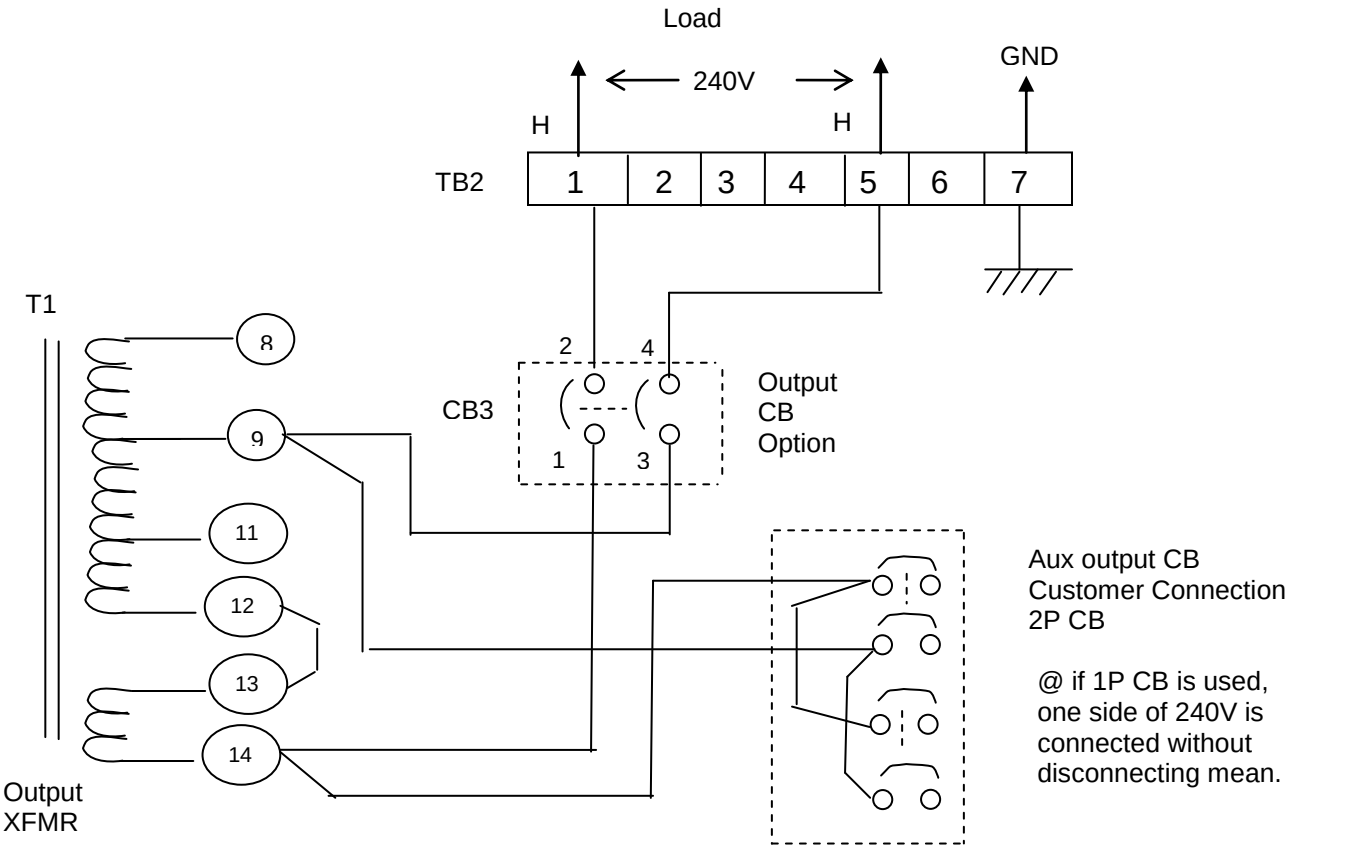


ILLUSTRATION 2-14: 240V Output Customer Connections w/ Output XFMR

(3) continued

(D) 277V Output connection

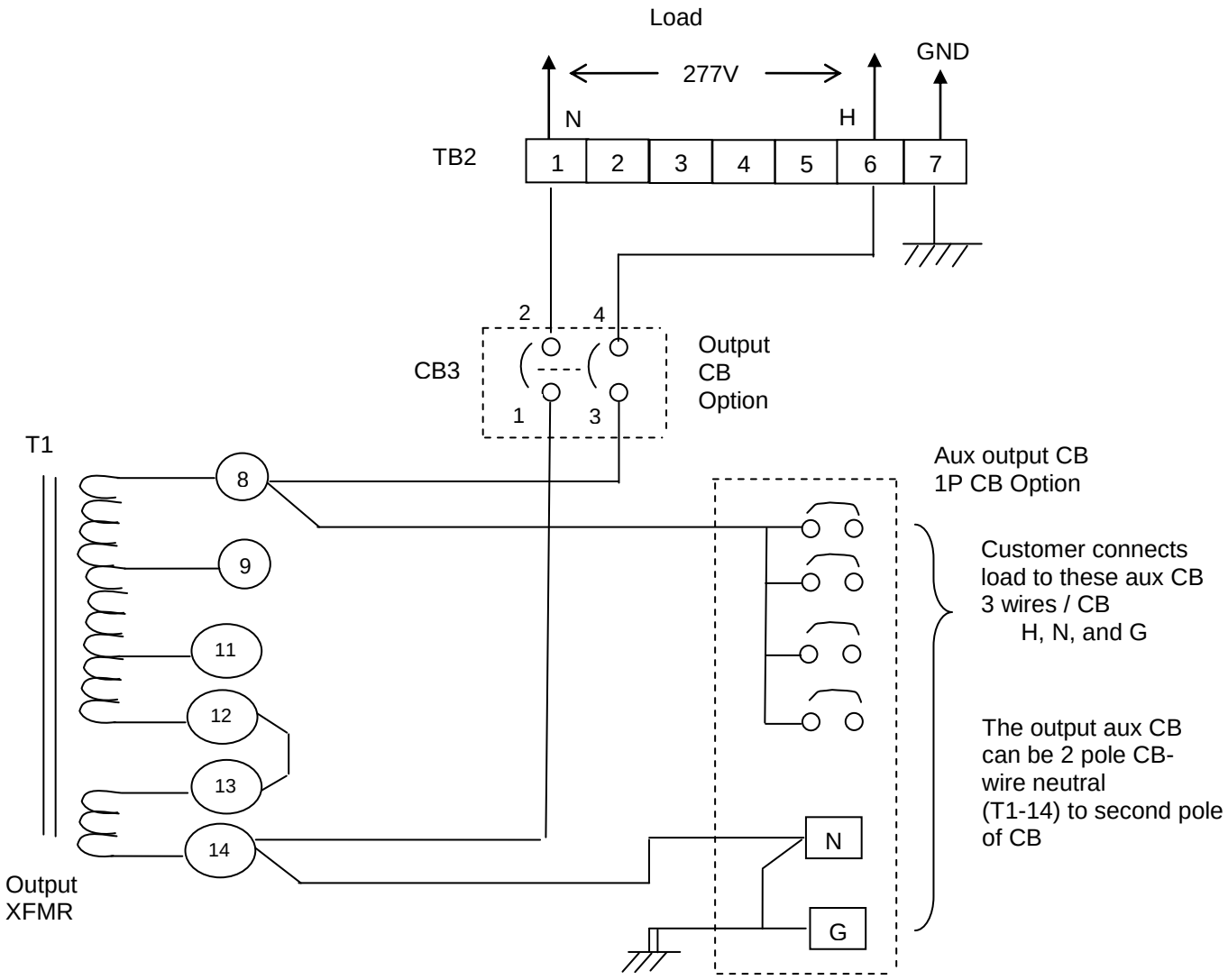


ILLUSTRATION 2-15: 277V Output Customer Connections w/ Output XFMR

(3) continued

(E) 120/240V Dual Output connection

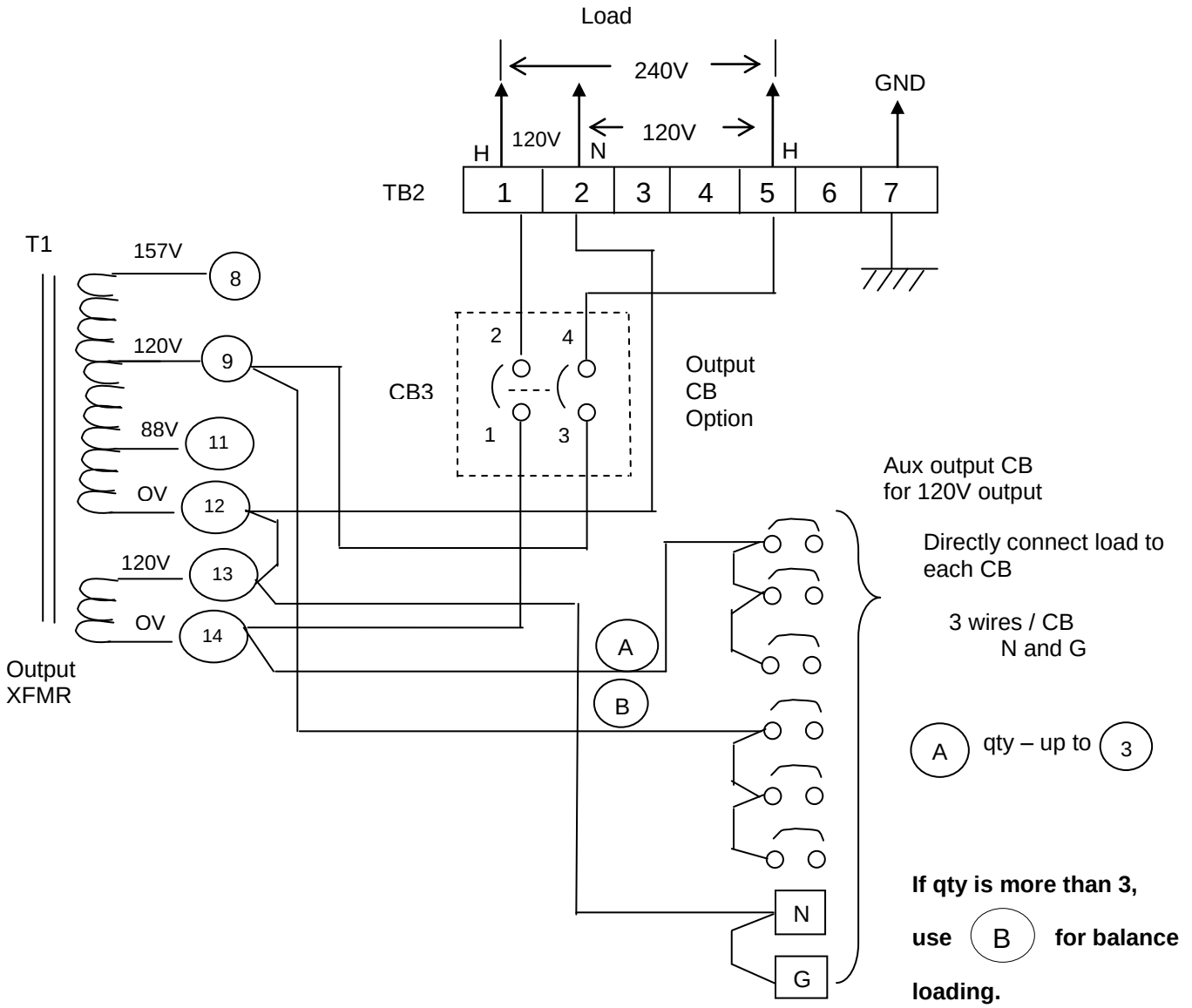
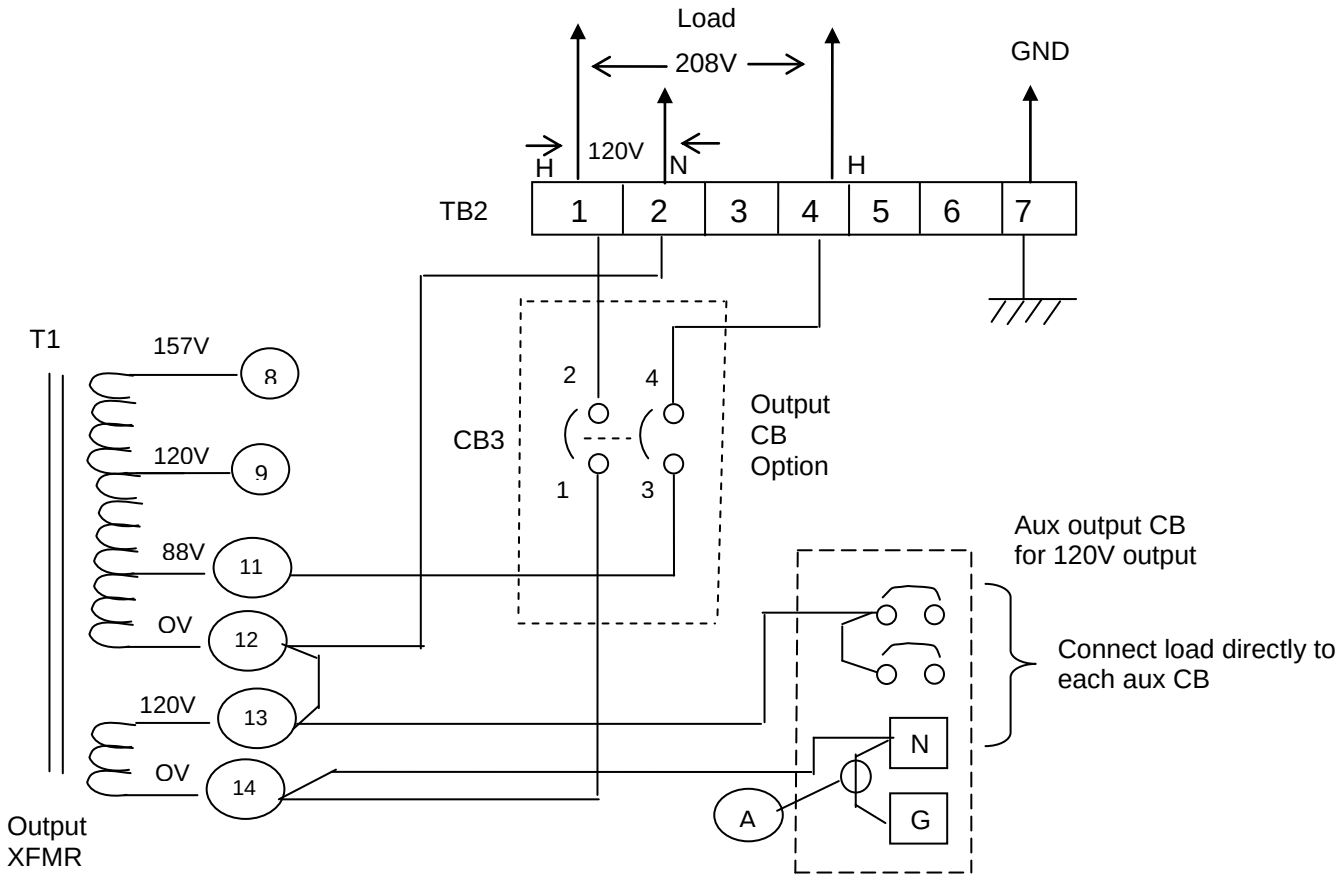


ILLUSTRATION 2-16: 120/240V Dual Output Customer Connections

(3) continued

(F) 120V / 208V Dual Output connections



(NOTE) For 120V and 208V dual output case,
TB2-1 or T1-14 can be treated
as a neutral point and can be tied
together neutral and ground.
If neutral and ground isolation is needed, disconnect (A) jumper.

ILLUSTRATION 2-17: 120/208V Dual Output Customer Connections

(3) continued

(G) 120V / 277V Dual Output connections

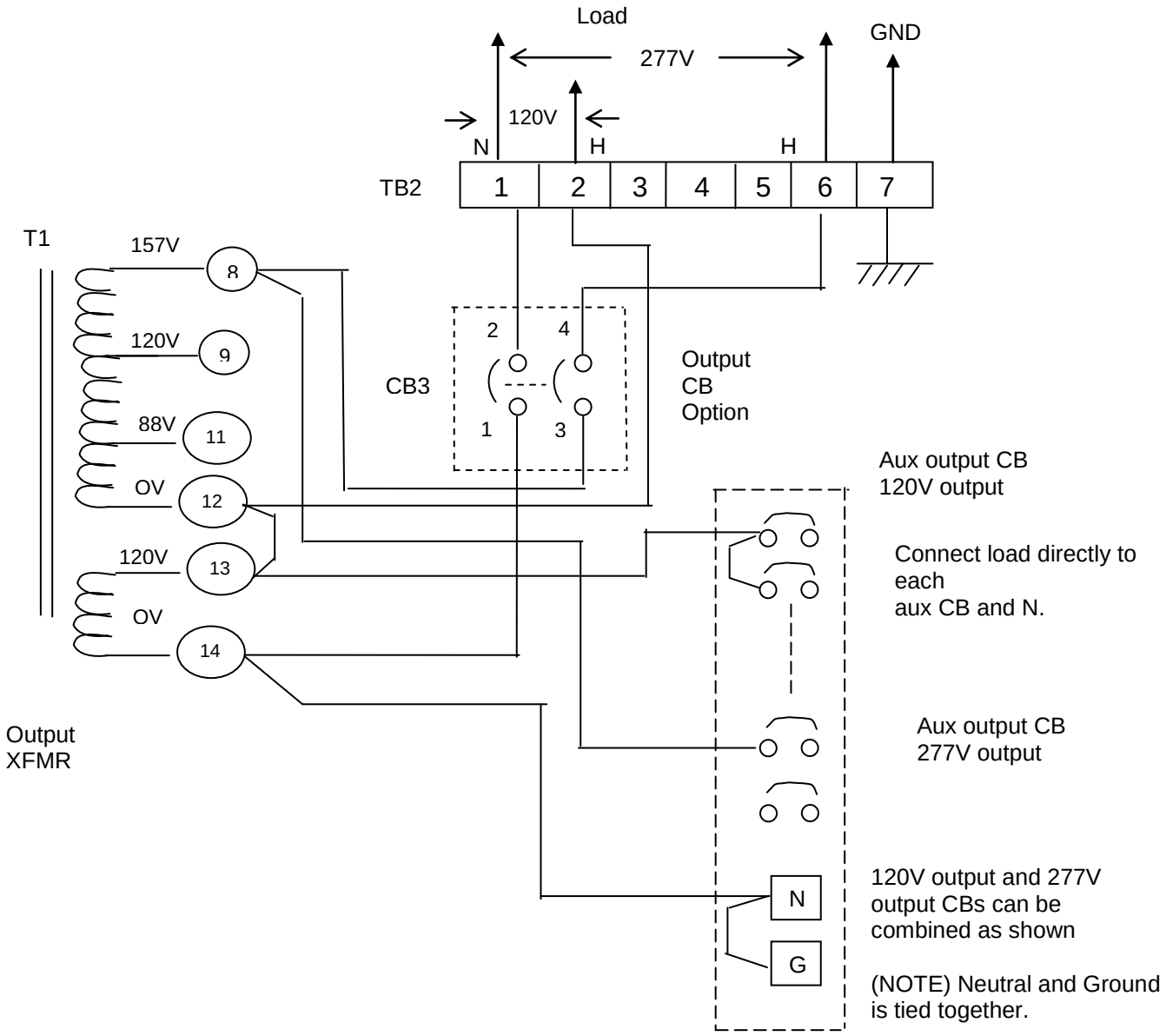


ILLUSTRATION 2-18: 120/2277V Dual Output Customer Connections

C. Battery Connections

For battery connections, please refer to the battery connection diagram for each sales order. There are various configurations due to battery run time and battery bus voltages. Appendix C-2, C-3, C-4, and C-5 show the maximum strings of each battery system as reference only.

WARNING!

USE BATTERY CONNECTION DIAGRAM FROM THE ACTUAL UNIT. EACH BATTERY CABINET SHOULD HAVE A COPY OF THE CONECCTION DIAGRAM. EACH UNIT CABINET SHOULD HAVE A COPY OF CONNECTION DIAGRAM. MAKE SURE THE BATTERY CONNECTION DIAGRAM NUMBER IN THE NAMEPLATE OF EACH UNIT MATCHS THE BATTERY CONNECTION DIAGRAM IN THE BATTERY CABINET. REFER TO A SAMPLE NAMEPLATE BELOW:

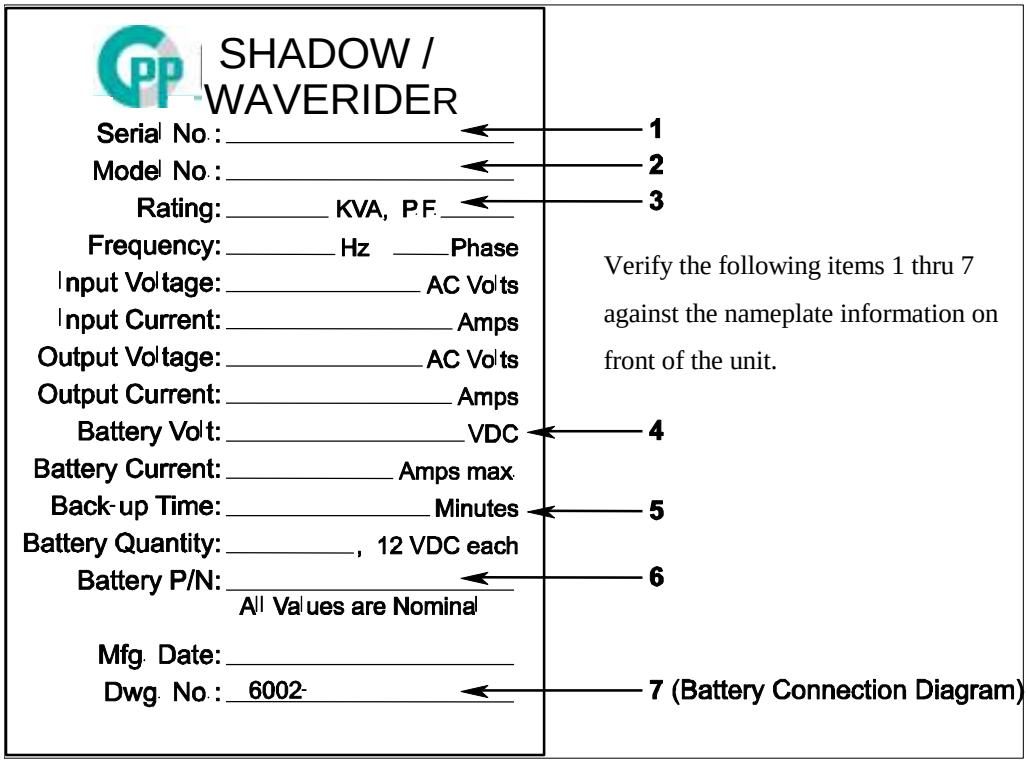

SHADOW / WAVERIDER
Serial No.: 1
Model No.: 2
Rating: KVA, P.F. 3
Frequency: Hz Phase
Input Voltage: AC Volts
Input Current: Amps
Output Voltage: AC Volts
Output Current: Amps
Battery Volt: VDC 4
Battery Current: Amps max.
Back-up Time: Minutes 5
Battery Quantity: , 12 VDC each
Battery P/N: 6
All Values are Nominal
Mfg. Date:
Dwg. No.: 6002- 7 (Battery Connection Diagram)
Verify the following items 1 thru 7 against the nameplate information on front of the unit.

ILLUSTRATION 2-19

2.4 REMOTE SIGNALING CONNECTIONS (OPTION)

The Wave Rider 1 includes the feature of providing dry relay contacts for remote signaling capabilities. Signals available for remote annunciation are:

"INPUT FAILURE" - N/O contact that closes upon loss of input power.

"LOW BATTERY" - N/O contact that closes when the unit is on battery operation and the batteries approach inadmissible discharge status.

"BYPASS ON" - N/O contact that closes when the unit transfers the load to static by-pass.

"SUMMARY ALARM" - N/O contact that closes when the unit has any one of the following alarm conditions. Internal Failure, System Overheat, Battery Under voltage.

2.4.1 Dry relay contacts for remote signaling are provided via connector (P2) on Control Board (A2), located on the inside of the right door of the enclosure. See illustration 3-2 for location of Control PCB.

2.4.2 Dry relay contacts have the following maximum ratings:
- 125 volts (AC or DC) maximum
- 1.25 amperes maximum
- 30 watts / 50 VA maximum

It is imperative that the relay contact ratings are not exceeded. Otherwise, damage to the relays within the Wave Rider 1 will occur.

2.4.3 Determine which signals will be used. Connect wires (customer-supplied) to the connector.

2.4.4 See illustration 3-2 for location of dry C contacts terminal.

This concludes the installation procedures. Please proceed to Section 4-1 Start-Up.

2.5 BATTERY STORAGE

The Wave Rider 1 System can be placed in storage while not in use. Provide a protected environment which meets the environmental parameters listed below.

- AMBIENT TEMPERATURE: -20° to 70°C (-4° to 158°F)
- RELATIVE HUMIDITY: 0% to 95% non-condensing

If the Wave Rider 1 will be stored for three months or longer, it should be serviced by charging the batteries for 24 hours at regular, three-month intervals. While in storage, service the unit using the procedures in this section.

2.5.1 Battery Maintenance

During long-term storage, the batteries are subject to aging and deterioration. After visual inspection, if the batteries need to be replaced, contact your Crucial Power dealer or the Crucial Power factory directly to purchase new batteries. Batteries matching sequence numbers used should be purchased to set-up a string.

If the unit is stored in its original packaging, unpack unit using unpacking procedures outlined in Equipment Unpacking Section 2.2.

If the unit is not connected to a source of power, first connect the unit to an appropriate power source using the procedures in Unit Installation Section 2.3.

Then recharge batteries as follows:

1. Unlock and open front doors.
2. Set AC input power source to ON.
3. Close input circuit breaker and wait for 1 minute,
4. Close battery circuit breaker, only when UPS Normal is displayed on screen.
5. The unit automatically recharges batteries. The LCD panel will indicate the battery voltage and charging current.
6. Allow unit to run for 24 hours to fully charge batteries.
7. When batteries have reached partial charge, the battery charging current will be under 1 Amp on LCD panel.
8. Open CB2 Battery Breaker
9. Turn OFF input power to the unit.
10. Close and lock front door.

SECTION 3 – GENERAL

3.1 INTRODUCTION

The Wave Rider 1 Central Lighting Inverters are manufactured to provide critical power for lighting during a power outage. The Wave Rider 1 meets or exceeds the life safety codes of UL924 and UL1778. These codes were established to allow the emergency lighting inverters to provide critical power to the lighting circuits during a power failure. The emergency lighting inverter will then provide power for 90 minutes that will allow safe and orderly evacuation from the facility.

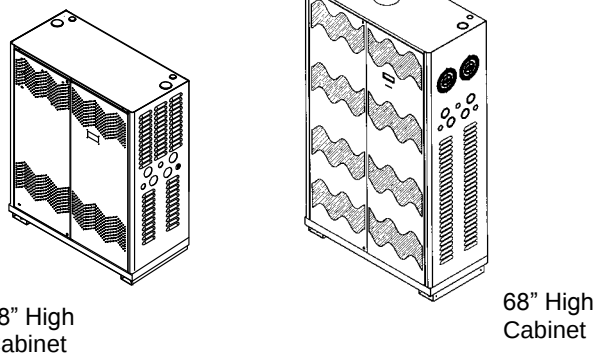
When input power to the Wave Rider 1 is lost during a power outage, the system will automatically draw power from its internal battery supply without any interruption. The critical load will receive only clean sine wave power. The optional output transformer allows multiple output voltages as well as input voltages that are different than output voltages. The internal VRLA (valve regulated lead-acid), maintenance-free batteries provide 90 minutes of backup power.

Upon restoration of input power, the Wave Rider 1 automatically resumes normal operation, and immediately begins to recharge the batteries.

The Wave Rider 1 has an internal bypass circuit, which maintains the power to the load in case of internal unit failure.

The Wave Rider 1 provides comprehensive monitoring capabilities. In addition to the LCD display, it provides five dry relay contacts for remote monitoring capabilities. Wave Rider 1 contains, as standard features, an AS 400, RS 232 protocol interface, RS485 data transmission ports and many other communication options.

The Wave Rider 1 is an on-line single phase PWM inverter available in output rating of 3, 5, 7.5, 12.5, 15, 20 kVA, and 3, 5, 7.5, 12.5, 15, 17 KW. The Wave Rider 1 is listed for compliance to UL1778, UL924, UL924A and CSA107.1 standards. The Wave Rider 1 is available with an input or output voltages of 120, 208, 240, or 277 VAC, single phase. This information is provided on the nameplate located on the inside front door of the unit. See Appendix A for a complete listing of the Wave Rider 1 specifications.



48” High Cabinet

68” High Cabinet

ILLUSTRATION 3-1: WAVE RIDER 1

3.2 BENEFITS

Electrical disturbances can come from practically anywhere: from the incoming power lines and even from within a building. Outside electrical disturbances include lightning strikes, utility switching, brown-outs, and accidents. Electrical disturbances in a facility can be caused by load cycling (elevators, HVAC systems, etc.), fault conditions, welders, and other electrically noisy equipment. Whether the electrical disturbances are generated outside or within the facility, the following power problems can occur:

Complete power outages;
Brown-outs including momentary sags;
Voltage surges;
Transients including common-mode and transverse-mode noise;
Frequency shifts and fluctuations.

Sensitive equipment needs protection from power problems. Without power protection, users of sensitive equipment may experience:

Loss of data;
Database corruption;
Rebuilding of files;
Equipment and component deterioration;
Premature equipment failures;
Unexpected equipment malfunctions;
Missed deadlines, especially during batch processing;
Loss of real time transaction processing;
Loss of employee productivity

The Wave Rider 1 is a self-contained unit a simple solution for back-up power for any fluorescent or incandescent lighting source such as overhead fixtures, exit signs, etc. It has been specifically designed to maintain 90 minutes of lighting power and ensure a safe building evacuation.

It offers significant advantages over other alternatives. For example, just one Wave Rider 1 Central Lighting Inverter can replace 70 "bug eyes" to make service and maintenance much quicker and easier.

The convection cooled, On-line PWM inverter system, is virtually silent and can be installed anywhere.

On-line PWM technology provides switchover from utility to battery power without any interruption.

The Wave Rider 1 is designed to fit the needs of virtually all power conditioning and unit applications. It has been designed to power all forms of modern data processing, communication, and process control equipment. The Wave Rider 1 does not require any de-rating, as other products may, when powering 100% electronic loads including switching mode power supplies.

The Wave Rider 1 protects sensitive electrical equipment, such as computer servers, telecommunication networks, LANs, multi-user, and instrumentation systems from electrical interference including problems associated with poor quality AC power sags and complete power outages.

3.3 PRODUCT FEATURES

The following describes the major blocks within the Wave Rider 1. Please refer to Illustration 3-2, System Component Layout to find specific items.

3.3.1 Input Contactor K1 (Illustration 3-2, Item 12)

The input contactor is multifunctional. First, it provides connections for the input power to the unit. Secondly, the contactor disconnects the input line when an outage occurs so that there is no back feeding of power into the power line. Finally, the contactor allows for automatic unit operation upon a complete discharge of the batteries. No operator intervention is required when power to the unit is restored after a complete battery discharge.

3.3.2 Battery Charger

The battery charger maintains the batteries at full charge. After a battery discharge, the charger will automatically recharge the batteries upon restoration of input power. This circuit is on the Power Board.

3.3.3 Power Board Assembly with IGBT's (Illustration 3-2, Item 1)

The Power Board is bolted onto the IGBT (**I**nsulated **G**ate **B**ipolar **T**ransistor) blocks that are mounted on a heat sink. The complete Heat Sink Assembly with IGBTs and Power Board is replaceable as a single part. This FRU (**F**ield **R**eplaceable **A**ssembly) converts all the power, i.e. input AC power converted to DC bus, battery power boosted to DC bus, and finally DC bus power converted to output AC power using PWM technology for a smooth AC sine wave. In case of a catastrophic failure, the complete Heat Sink Assembly is easily replaceable using only a screwdriver. The Power Board also contains the housekeeping power supplies and drivers for the IGBTs. The entire assembly provides the landing place for all internal input, output, DC cables and metering devices for control and monitoring of the unit input and output currents.

3.3.4 Control Board (Illustration 3-2, Item 10)

The microprocessor with unit specific firmware and control circuitry is located on the Control Board. The Control Board is mounted on the cabinet door and communicates with the Power Board (A2) via a ribbon cable. It monitors the input and output voltages and generates the command to close or open the input contactor and to sense and change the status of the bypass static switch. The Control Board sends data to the LCD panel located on the door where actual status and parameters are displayed. It additionally has AS400, RS232, and RS485 output capabilities and supports various communication including SNMP options.

3.3.5 Output Static Switch (Illustration 3-2, Item 3)

This SCR solid-state switch connects the output of the inverter (UPS) to the load. It is connected on the primary side of the optional output isolation transformer. This switch shuts off in case of a problem or failure within the unit and transfers the load directly to the utility input via the bypass static switch. It maintains it's status opposite to that of bypass switch.

3.3.6 LCD Display Panel (Illustration 3-2, Item 11)

The LCD (**L**iquid **C**rystal **D**isplay) panel provides all the input, output, battery metering and alarm data, and UPS status for customer use on a constantly scrolling set of 2 default screens with continuous update.

3.3.7 Optional Output Isolation Transformer (Illustration 3-2, Item 20)

The output isolation transformer provides isolation between the inverter and protected output. The power to the primary of this transformer is received from unit and is transformed to required output voltage levels. It will also add another screen to the main menu.

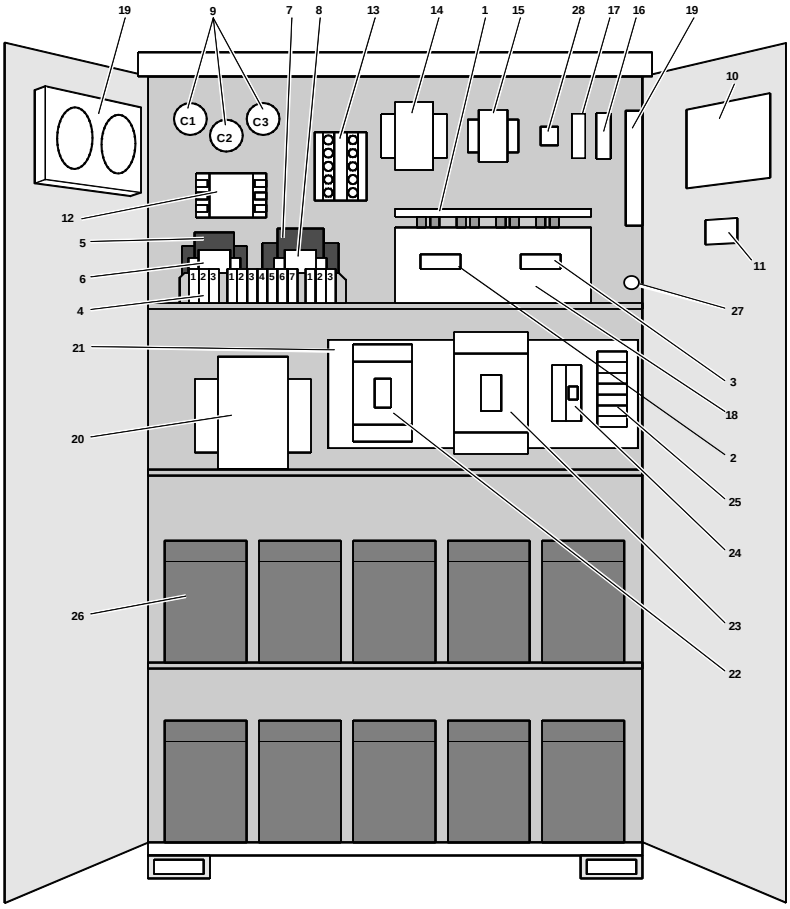
3.3.8 Optional Maintenance Bypass Switch (Illustration 3-2, Item 2)

The MBS (**M**aintenance **B**ypass **S**witch) removes the critical load from the backup power and providing utility input directly to the load in case of a malfunction of the unit or during system maintenance.

3.3.9 Battery Bank (Illustration 3-2, Item 26)

The battery bank consists of sealed, maintenance-free batteries. The batteries provide emergency power during power outages. The battery bank includes a breaker for over current protection and DC disconnect.

3.3.10 System Component Layout)



1) Power Board (A1)
2) Bypass Static Switch (PB1)
3) Output Static Switch (PB2)
4) Input/Output/Battery Terminal Block for customer's use (TB1, TB2, TB3)
5) Input Choke (L2)
6) Output Choke (L3)
7) DC Choke (L4)
8) Input Choke (L1)
9) High Frequency Noise Filter Capacitors for Input (C1), Output (C2), and Battery (C3) Power
10) Control Board (A2)
11) LCD Display Board
12) Input Contactor (K1)
13) Terminal Block to remove heat sink assembly (TB4)
14) Fan Transformer (T3)
15) Control Power Transformer (T2)
16) Control Transformer Fuse (F1)
17) Fan Fuse (F2)
18) Heat Sink
19) Fan(s)
20) Optional Output Isolation Transformer (T1)
21) Breaker Panel
22) Input Breaker (CB2)
23) Battery Breaker (CB1)
24) Output Breaker (CB3)
25) Output Distribution Breakers (CB4 and on)
26) Maintenance Free Lead Acit Battery(s)
27) Inverter Test Switch (S2)
28) Rectifier Block (BR1)

ILLUSTRATION 3-2: COMPONENT LAYOUT

3.4 FUNCTIONAL DESCRIPTION

Illustrations 3-3 depict FUNCTIONAL block diagrams of the Wave Rider 1. These diagrams provide an excellent tool for identifying the major building blocks within the Wave Rider 1.

3.4.1 Main input circuit breaker - optional

The main input circuit breaker provides Wave Rider 1 with incoming power isolation and input over current protection.

3.4.2 Input Contactor

Input contactor controls power applied to the unit. The microprocessor control circuit verifies that the unit is in "normal" and not at a "fault" condition and that the input voltage and frequency are within an acceptable range. Only then it energizes the contactor closing coil via control transformer and fuse.

3.4.3 Input Inductors

The input inductors are a single phase input filter.

3.4.4 Inverter

When the AC input power is not available to power the load, the inverter converts the energy stored in the battery bank to AC power to supply power to the load. The pulse width modulated (PWM) inverter utilizes high speed, high efficiency IGBT's for fast response, sinusoidal power.

3.4.5 Battery charger

The battery charger converts AC power into regulated DC power to re-charge and to maintain the charge on the battery bank. The charger is fully automatic with a current limiting feature so that battery damage will be prevented in case of a charger malfunction. The charger is sized such that the batteries will be maintained at full charge even when the input voltage is at the low line limit for indefinite periods of time.

3.4.6 Battery

The battery bank, shall consist of 8, 10, 16, 20, or 32, 12 Volt batteries, providing the reserve energy to sustain the load when suitable AC input power is not present. The batteries are sealed, maintenance-free, VRLA (**V**alve **R**egulated **L**ead **A**cid) construction.

3.4.7 DC Choke

The DC choke helps boost battery voltage to a higher internal DC bus voltage while it reduces high frequency noise.

3.4.8 Output Transformer (used only for multiple output voltage units)

The Output transformer performs two critical functions. First, it provides excellent common mode and normal mode noise isolation of the load from the input or inverter power. Secondly, it provides voltage transformation and tight regulation of the output voltage while the Wave Rider is operating from its internal inverter and it can be utilize to provide a different voltage than input (source voltage).

3.4.9 Inverter Test Switch

The SW-2 test momentary switch is a push button switch for testing the Wave Rider 1 and the batteries for proper operation. When the Wave Rider 1 is running and Switch SW-2 is pushed and held in, the Wave Rider 1 will automatically transfer to battery operation. The Wave Rider 1 will continue to run on batteries until the switch is released. When the switch is released, the Wave Rider 1 returns to normal operation (provided input power is present).

3.4.10 Power Supply Transformer

This transformer with fuse (F1), provides internal housekeeping DC power supply. The primary of this transformer has taps to match with the input voltage.

3.4.11 Control Transformer (T2)

Transformer with 120 VAC secondary for control of the K1 contactor coil from the A1 control board.

3.4.12 Maintenance Bypass Switch

This Maintenance Bypass Switch (MBS) allows the Wave Rider 1 to be switched off line for maintenance or troubleshooting when the inverter malfunctions or PM (Periodic Maintenance) is required. The MBS transfers the input power directly to critical load without any break or power disruption. Before switching the MBS to the maintenance position, turn on toggle switch S1 if unit is so equipped, and then rotate the maintenance bypass switch to the maintenance (MAN) position. Refer to the operation label on the unit. After repair or periodic maintenance, the MBS must be switched to UPS position, in cases where the toggle switch has been incorporated with the switch, be sure not to leave the switch in the middle position as this will not provide any output power when the unit is off.

Caution!

STOPPING ROTATION OF THE MAINTENANCE BYPASS SWITCH BETWEEN POSITIONS WILL RESULT IN THE REMOVAL OF OUTPUT VOLTAGE.

3.4.13 Fan Transformer

The Fan transformer provides 120 VAC to the fans(s) with taps to match unit output voltages. Fuse F2 protects fans & transformer.

3.4.14 Efficiency Optimizer Function: (OFF Line Inverter Mode)

When Input Power is available, the batteries shall be charged and AC output from inverter thru inverter static switch supports to the critical load. In this Normal Mode Operation, the inverter static switch is closed and bypass static switch is opened. The bypass static switch is closed only upon inverter faults or upon manual operation and then output power thru bypass static switch supports critical load. This is normal operation for true-double convention UPS. However there is demand for higher efficiency UPS in industry to reduce cost of electricity and want to use as “off-line inverter” which means that normal operating mode is reversed such that bypass static switch is closed normally as long as input voltage and input frequency are within ±10% permissible windows of normal voltage and ±3hz of normal frequencies and inverter static switch is opened. The inverter static switch is only closed upon the failure of input power or upon out of voltage and frequency normal ranges. This is called the “off line inverter mode” and system efficiency is higher as 98% and reduces the total power loss. The output AC voltage in the mode of operation follows proportionally to the input line voltage. In another words, there is no output voltage regulation within ±10% window voltage range or ± 15% (selectable) window voltage range. There are two versions, one is fast transferring with a quarter of cycle (2.5 milli-second), another is slow transferring with 25 cycles (400 milli-second second to 1second).Fast transferring time is required when the loads are sensitive to voltages such as HID lights and other that any voltage disturbance effects their operation. One must consider that higher efficiency of unit is only requirement and output voltage regulation is not critical as much. Option part numbers refer to **5.18** options AC off-line inverter operation with 2 version of transferring time.

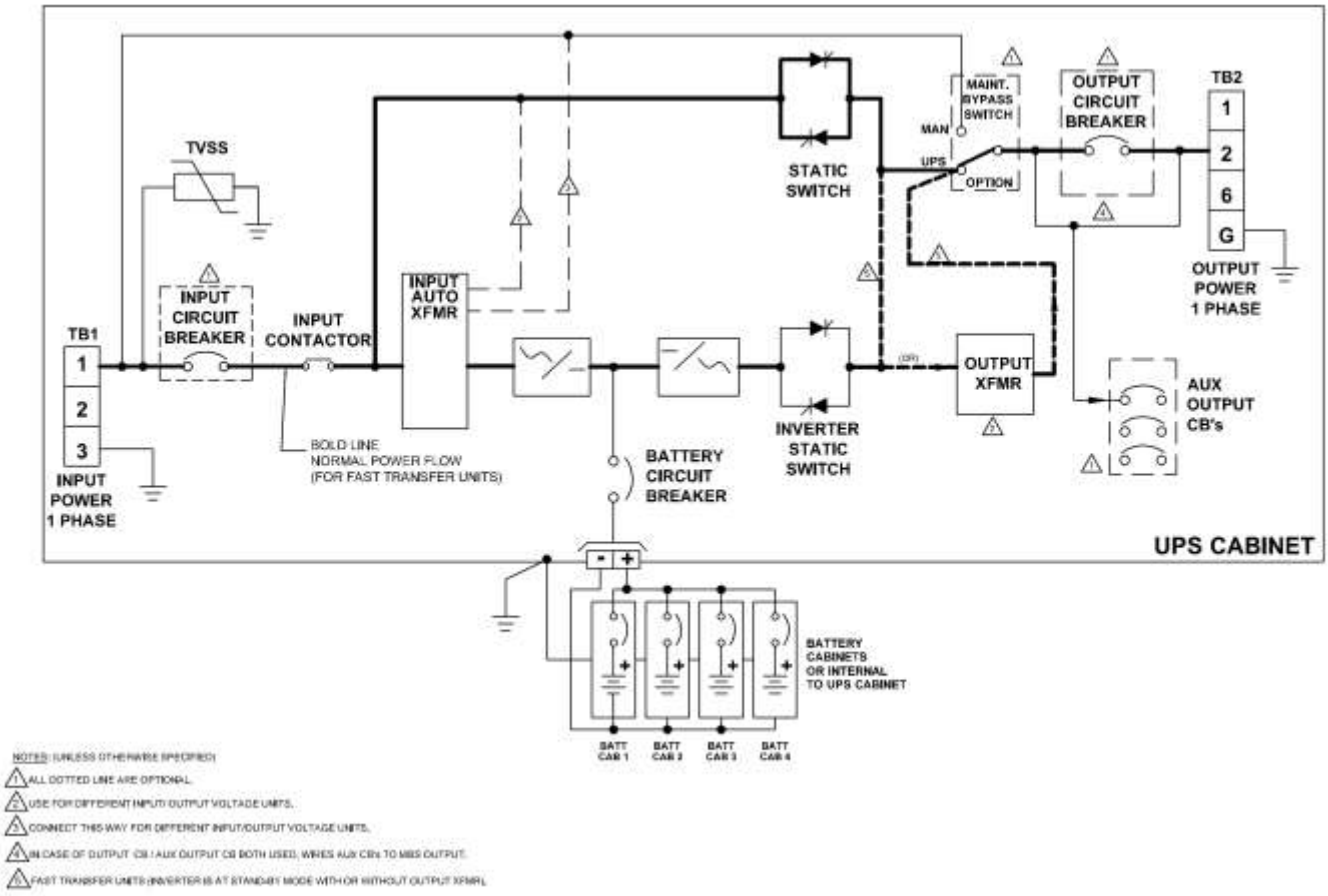


ILLUSTRATION 3-3: FUNCTIONAL BLOCK DIAGRAM

3.5 THEORY OF OPERATION

3.5.1 Standby Mode

After power is applied, the system is placed in STANDBY mode and a self-check starts. During this period, the start subroutine checks for the input voltage and proper operation of the inverter and bypass SCR's. After the routine is completed and check confirmed OK, the system goes into the NORMAL mode.

3.5.2 Normal Mode

The input contactor K1 receives a closing signal, connecting input power to the DC supply transformer. The DC rectifier supplies the battery charger, Control Board and the DC/AC inverter circuit. The battery charger is then activated allowing the batteries to be continuously charged. The on-line DC/AC inverter converts the DC voltage to a pulse-width-modulation (PWM) waveform. This waveform is filtered and reconstructed back to a desired AC output.

3.5.3 Response To Input Power Failure

If the system controller senses a change in input frequency of more than $\pm$3 Hz or an out of range input voltage, it will consider it an input failure and will immediately open the input contactor, isolating the unit from the facility. At the same time, the charger is turned off and the battery bank becomes a DC supply source to the inverter circuit, maintaining an uninterrupted AC supply to the protected load. The LCD screen will display a "UPS ALARM" message. When the facility power returns, stabilizes and is in phase with the backup power, the system controller closes the input contactor and the system returns to NORMAL. If the battery voltage drops below 16% of its nominal value and the facility power remains off, then the system will assume a ALERT mode.

3.5.4 UPS ALERT

The System controller will issue a ALERT message on the LCD screen if any of the following conditions happen:

Internal failure

System overheats

Battery bank under voltage

During a ALERT, the system stops its backup operation, inverter SCRs are switched OFF, and bypass SCRs are switched ON. A summary alarm 5V signal is sent to the hardwired interface. The system remains in this mode until power is cycled or system has been repaired when needed.

3.5.5 UPS ALARM

The System controller will issue a UPS ALARM message on the LCD screen if any of the following conditions occur:

Input power failure

Output overload

During a ALARM mode, inverter IGBTs remain on and an alarm signal may be sent to the signal interface. The system will reset itself as soon as the problems disappear.

3.6 OUTPUT LOADS

The Wave Rider 1 is designed to power any fluorescent or incandescent and HID lighting. There are, however, certain types of loads that exhibit an excessive inrush current when first turned on or at other times during operation.

The capacity of the Wave Rider 1 may need to be greater than what would be estimated based on the nameplate requirements of loads previously discussed. Contact your Crucial Power dealer or the factory directly if you have any questions about powering unusual loads from your Wave Rider 1.

3.7 OPTIONS (See Section 5 for details)

The following options are available with the Wave Rider 1:

Internal / External Manual Bypass Switch
Audio Alarms with Silence Switch
Remote UPS Status Display, 1 phase Monitor
Form “C” N/O Contacts for Alarms
TVSS (Transient Voltage Surge Suppressor)
Normally ON/OFF Output Aux. Circuit Breakers
External Output Aux. Circuit Breakers in Panel Board
Stackable Cabinet Rack
System Input CB Standard/Higher KAIC
System Output CB Standard/Higher KAIC
Higher KAIC Norm .ON/OFF Output Circuit Breaker, Molded case
Higher KAIC Norm. ON/OFF Output Circuit Breaker 1 Phase. Din rail
Seismic Mounting Bracket (Left and Right set per cabinet)
Power Flow Mimic
GMS (Global Monitoring System)

- Local via PC with RS232
- Local via PC with RS485
- Basic NetAgent SNMP
- Basic NetAgent SNMP with WIFI HUB application
- Advanced NetAgent SNMP
- Advanced NetAgent SNMP with WIFI HUB.
- Advanced NetAgent SNMP with GPRS mobile modem.
- Advanced NetAgent SNMP with dial-up modem

ECC – Emergency Circuit Converter

ECM – Emergency Control Module

SECTION 4 – OPERATION

4.1 START-UP PROCEDURES

The unit's batteries are shipped directly from battery the manufacturer to insure brand new batteries and allow an opportunity for the installing contractor to schedule their arrival when they are ready to commission the system. The battery cabinet and the interconnect cables are shipped with the electronics section of the inverter in a cardboard box located inside each battery cabinet.

Crucial Power service personnel must perform initial start-up or a factory trained authorized representative. To request start-up, fax a completed Request Turn-On form (6002-1545) to 800-246-2346 or e-mail it to info@800pwrsrvc.com. Form is now available in the web at www.800pwrsrvc.com.

The start-up procedure described in this manual is a reference only to a start up of the Wave Rider 1 for maintenance and shutdown.

Please be sure not to start up the unit without the assistance of a factory trained, authorize personal as failure to do so may damage the unit and void the unit warrantee.

4.1.1 Verify that the main input circuit breaker, battery breaker, and output circuit breaker(s), are in the ”OFF” or ”down” positions. Refer to illustration 3-2 for the location of the circuit breakers.

4.1.2 Check all cable connections are firmly secured.

Caution **If during the start-up procedures anything unusual occurs, immediately turn off the input circuit breaker, and contact Crucial Power at (800) 797-7782 for technical assistance. Also, use this number for any other questions or additional information.**

Caution **The main input power and reserve input power should be available at same time when dual input power sources are used.**

4.1.3 Apply input power to the Wave Rider 1

Input Circuit Breaker remains open.

Verify that the voltage measured on the input circuit breaker is 120/208/240/ or 277 VAC and is the same as nameplate voltage rating. If the voltage is not the same as on nameplate within +15% to -10% tolerance, do not proceed any further. Contact Crucial Power at (800) 797-7782 for technical assistance.

Verify that there are no voltages measured on the output terminal block.

4.1.4 Turn on the main input circuit breaker.

4.1.5 After turning on the system, wait one (1) minute while the Wave Rider 1 runs through its internal diagnostic routines.

Hear the sound of contactor closing.

See the fan(s) running.

See the LCD display screen showing UPS Normal message.

Line 1	UPS NORMAL @ XX kVA
Line 2	INPUT OK @ CHRG ON
Line 3	BATTERY OK @ DC OK
Line 4	ON INVERTER @ OUT OK

Verify that the LCD display panel indicates all correct parameters - see Appendix D for details.

Verify that the output voltage is 120/208/240/277 VAC per the nameplate.

4.1.6 Close battery breaker in the unit cabinet [and in battery cabinet(s)].

4.1.7 At this time, the Wave Rider 1 should be providing AC line power. If the Wave Rider 1 is not operating in the normal mode, turn off the input circuit breaker. Contact Crucial Power at (800) 797-7782 for technical assistance.

4.1.8 Recheck that the output voltage is 120/208/240/ or 277 VAC.

If the output voltage is approximately the same as the nameplate, turn on the loads.

4.1.9 Verify battery operation and the inverter test switch.

To place the Wave Rider 1 in battery operation (simulate loss of input power), press and hold yellow Inverter Test Push Button. With Push Button in the hold position, the Wave Rider 1 should be running on its internal batteries.

Verify that the LCD panel displays is as below, where “xx” is the kVA of this unit:

Line 1	UPS ALARM @ XX kVA
Line 2	INPUT BAD @ CHRGR ON
Line 3	BATTERY OK @ DC OK
Line 4	ON INVERTER @ OUT OK

Release the yellow Inverter Push Button and Verify that the LCD PANEL displays “INPUT OK @ CHRGR ON”.

Caution **Be sure to release the Push Button, after the test, so it will not deplete the batteries.**

4.1.10 The Wave Rider 1 is now fully functional - providing clean, sine wave power to the load with battery back-up in case of an input power failure.

This concludes the start-up procedures.

4.2 OPERATION

4.2.1 Turning On the Wave Rider 1

1 Apply input power.

2. With input power available, turn on the main input circuit breaker.
3. Wait until you hear the input contactor closing and fan running.
4. Close the battery circuit breaker, only after the LCD display is lit and displays screens per Appendix D.
5. Verify that all parameters on the LCD display panel are proper. See Appendix D for display details.
6. Close the output circuit breaker.
7. Turn On the auxiliary output circuit breakers.

4.2.2 Turning Off the Wave Rider 1

Turn off the Output Breaker(s), Battery Breaker, and Input Breaker.

4.3 FIELD REPLACEABLE UNITS (FRUS)

Refer to Table 4-1 for ordering the replacement parts from the factory. Supply the information from the unit's nameplate, including the serial number, model number, KVA, P.F., input/output battery voltages, and date of manufacture, when ordering parts from factory. Call Toll Free (800) PWR-SRVC in North America. Replacement parts must be replaced by qualified factory trained service personnel only.

Circuit boards and IGBTs contain ESDS (ElectroStatic Discharge Susecptable) components. Handle and package ESDS devices in accordance with JEDEC standard JESD625-A. Use a grounded ESD wrist strap when handling the devices and circuit boards. Always package components and circuit boards in static-dissipative plastic bags before transporting even if a device has failed. Failure to do so could result in further damage, complicating repair and failure analysis.

4.3.1 Control Board

This Control Board is located on the inside right door at the top and mounted at 4 corners with screws and washers. Verify that all connectors are matches with their designations and pins #1, 2, etc. Unplug P1 through P15. Install the new board. Reconnect all plugs and connections maintain them with their original orientations.

4.3.2 All Other Parts

Verify that the cables are marked before disconnecting. Replace the defective part with the new part. Reconnect wiring the same way as it was disconnected.

4.3.3 Heat Sink Assembly Replacement Procedure

1) Disconnect and isolate all sources of power.
2) The Heat Sink Assembly is located on the right side of the top electronic shelf, inside the unit cabinet (Illustration 4-1). Verify that all cables and connectors have labels and are identified as shown. This is important for reinstalling the assembly.
3) Disconnect connectors P7, P6, P4, P1 from the PCB, A1, which is mounted horizontally on the big black heat sink.
4) Disconnect 5 power cables at TB4-1 through TB4-5 using flat screw driver. Verify and install label ID for each cable before disconnecting.
5) Loosen 3 Phillips head screws at front holding heat sink bracket. Pull the complete assembly forward and up. Remove it from tray gently, making sure that no cables or wires are catching (See illustration 4-1).
6) Install new assembly in the reverse order. Note that the rear bracket attached to the heat sink slides under the bracket secured on to the back panel. Slide the assembly back and reinstall 3 Phillips screws.
7) Reinstall all the cables and connectors in the reverse order. Verify per illustration 4-1.
8) Verify connections prior to starting up the unit.

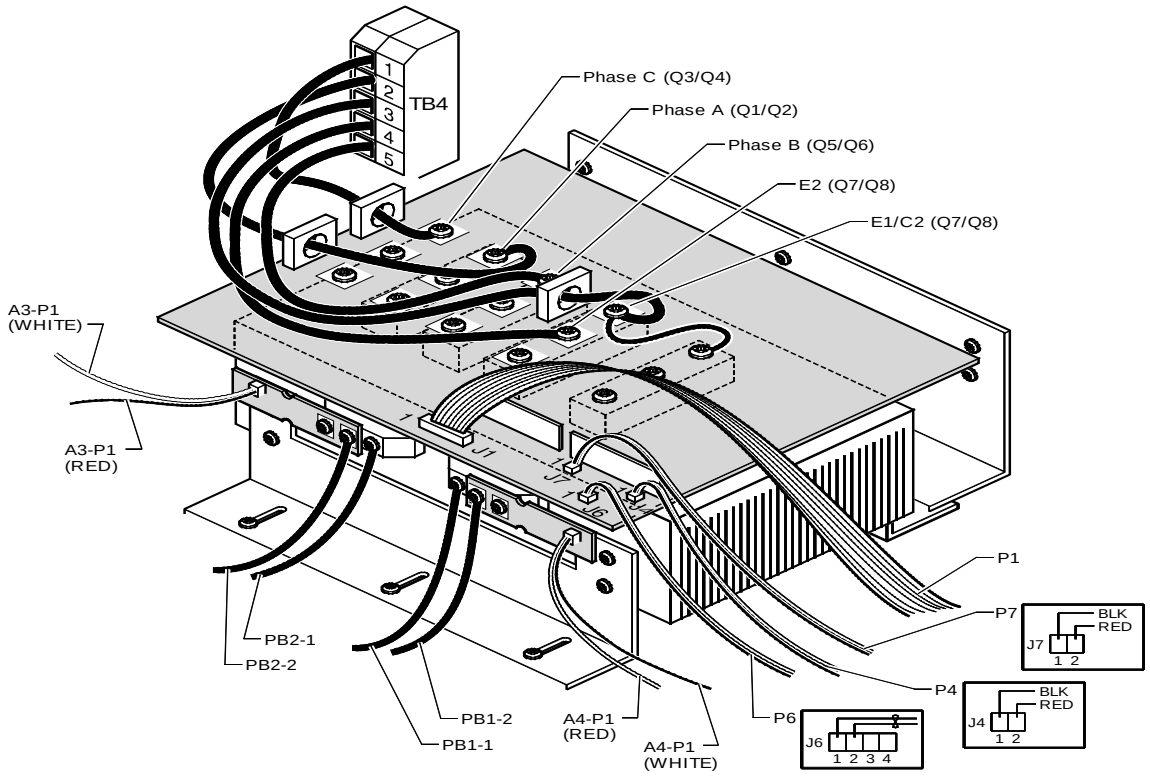


ILLUSTRATION 4-1: HEAT SINK ASSEMBLY (FRU)

4.4 RENEWAL PARTS

Table 4-1: System Parts

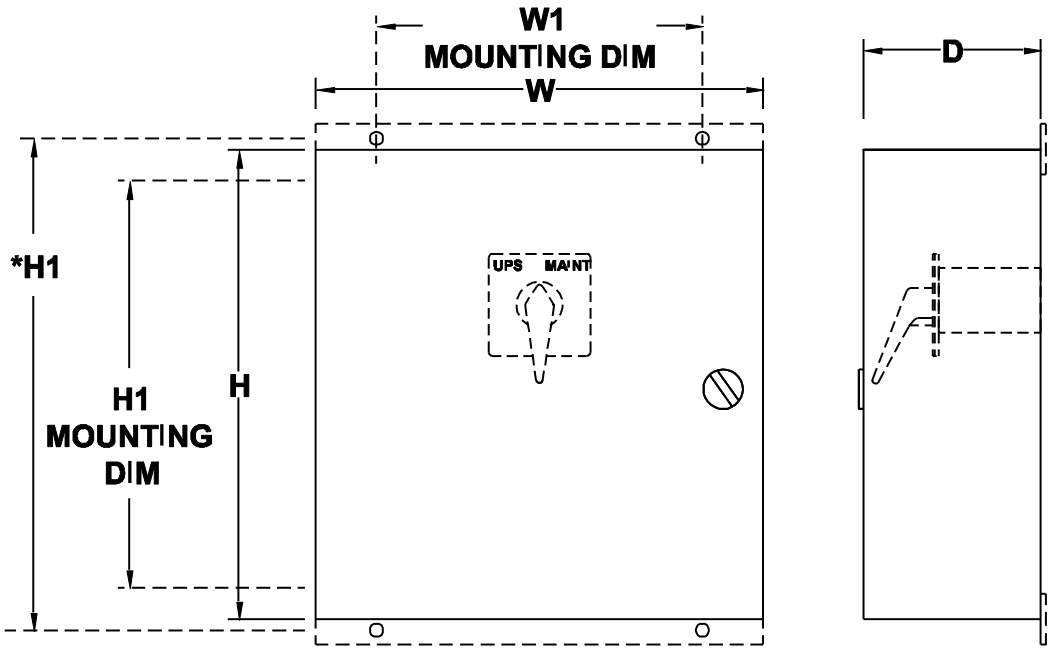
ITEM	QTY	DESCRIPTION	DESIGN
1	1	Power Board	A1
2	1	Bypass Static Switch	PB2
3	1	Output Static Switch	PB1
4	1	Input/Output/Battery Terminal Block for customer's use	TB1, TB2, TB3
5	1	Input Choke	L1, L3
6	1	Output Choke	L2
7	1	DC Choke	L4
8	1	The Frequency Noise Filter Capacitors for output Power	C1, C2, C3
9	1	Control Board	A2
10	1	LCD Display Board	A5
11	1	Input Contactor	K1
12	1	Terminal Block to remove heat sink assembly	TB4
13	1	Fan Transformer	T3
14	1	Control Power Transformer	T2
15	1	Control Transformer Fuse	F1
16	1	Fan Fuse	F2
17	1	Heat Sink Assembly	HS1
18	1	Fan(s)	B1 thru B5
19	1	Optional Output Isolation Transformer	T1
20	1	Input Breaker	CB2
21	1	Battery Breaker	CB1
22	1	Output Breaker	CB3
23	1	Output Distribution Breaker	CB4 and Up
24	8, 10, 16, 20	Maintenance Free Lead Acid Battery(s)	B1 and Up

SECTION 5 – SYSTEM OPTIONS

This section describes options available with the Wave Rider 1 phase. The following are available:

Part Number	Options
3000-044 thru -056	External Manual Bypass Switch
9100-1359-01 thru -04	Internal Manual Bypass Switch
9100-1363-01	Audio Alarms with Silence Switch
9100-1020-06	Remote UNIT Status Display
9100-1362-01	Form “C” N/O Contacts for Alarms
9100-1401-02, -12, -13	TVSS (Transient Voltage Surge Suppressor)
9100-1343-01 thru -16	Normally ON/OFF Output Aux. Circuit Breakers
9100-1439-01 thru -03	External Output Aux. Circuit Breakers in Panel Board
9100-1429-xx	Stackable Rack (1 rack per 2 cabinets)
N/A	System Input CB Standard/Higher KAIC
N/A	System Output CB Standard/Higher KAIC
9100-1434-31 thru 86	Higher KAIC Norm .ON/OFF Output Circuit Breaker, Molded case (208/240)
9100-1435-01-26, 61-86	Higher KAIC Norm. ON/OFF Output Circuit Breaker 1 Phase. Din rail (277V)
9100-1317-02	Seismic Mounting Bracket (Left and Right set per cabinet)
9100-1493-01	Power Flow Mimic
	GMS (Global Monitoring System)
9800-005-xx	Local on PC - via RS232
9800-006-01	Local on PC - via RS485
9800-007-01	Basic NetAgent SNMP
9800-007-02	Basic NetAgent SNMP with WIFI HUB
9800-008-01	Advanced NetAgent SNMP
9800-008-02	Advanced NetAgent SNMP with WIFI HUB
9800-008-03	Advanced NetAgent SNMP with mobile GPRS modem
9800-008-04	Advanced NetAgent SNMP with Dial-up modem
9100-1501	ECC – EMERGENCY CIRCUIT CONVERTER
9100-1502	ECM – EMERGENCY CONTROL MODULE

5.1 Optional External Maintenance Bypass Switch – P/N 3000-044 thru -056



PART NO.	AMP	ENCLOSURE SIZE "INCH"				
		W	H	D	W1	H1
3000-044	55 AMP	14	16	8	*12	*16.75
3000-045	110 AMP	14	16	10	*12	*16.75

ENCLOSURE DIM'S

SELECTION CHART FOR SINGLE PHASE UPS

KW/KVA 3	KW/KVA 5	KW/KVA 7.5	KW/KVA 10	KW/KVA 15	KVA/KW 20/17	FOR WIRING DIAGRAM SEE DWG
3000-045	3000-044	3000-044	3000-045	3000-045	3000-045	6001-032-31S

1) SWITCH CONTACTS ARE SINGLE PHASE L-NEUTRAL "MAKE BEFORE-BREAK".
2) CONTACTS MARKED "UPS" ARE CLOSED IN THE "UPS" POSITION.
3) CONTACTS MARKED "MAINT" ARE CLOSED IN THE "MAINT" POSITION.
4) WRAP AROUND BY-PASS SWITCH SHOULD BE USED WITH SAME INPUT /OUTPUT VOLTAGE.
5) WRAP AROUND BY-PASS SWITCH CAN ONLY BE USED WITHOUT ANY BUILT IN SECONDARY DISTRIBUTION CIRCUIT BREAKERS IN UPS.

ILLUSTRATION 5-1: EXTERNAL MAINTENANCE BYPASS SWITCH

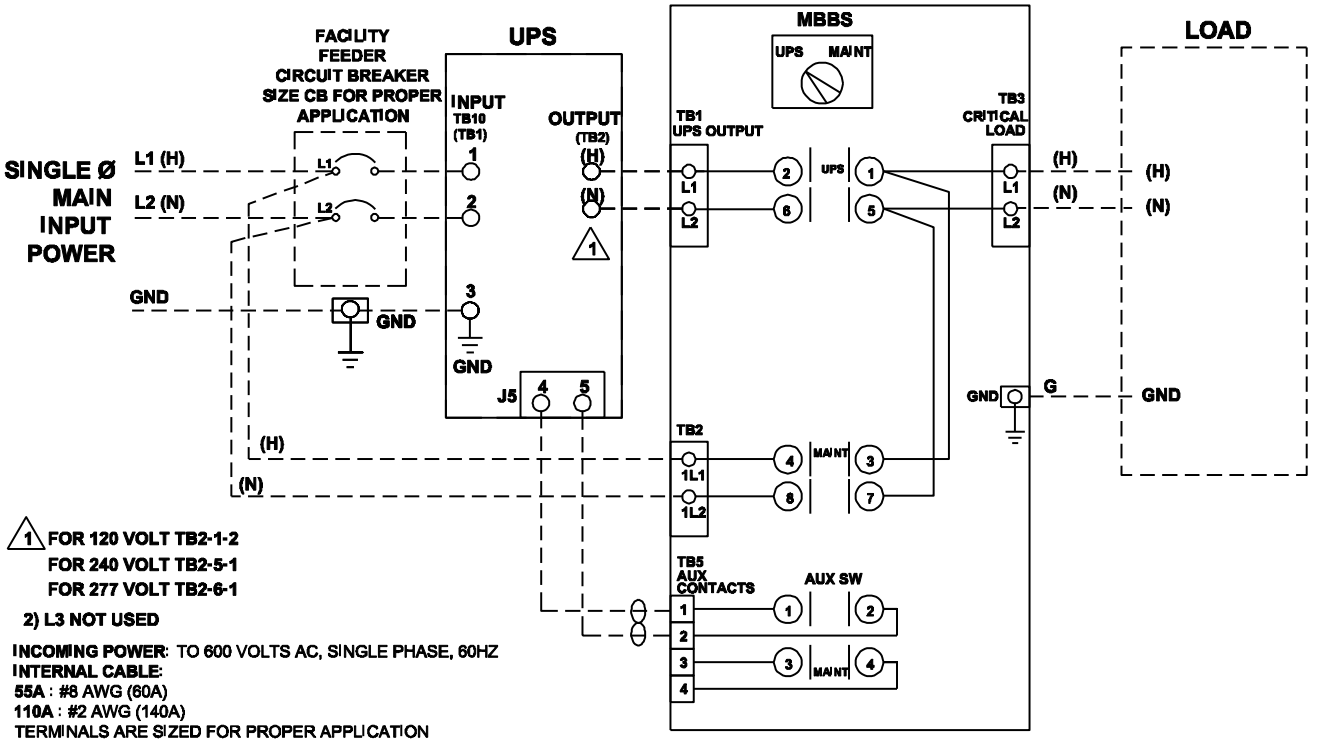


ILLUSTRATION 5-2: MAINTENANCE BYPASS SWITCH WIRING DIAGRAM

5.1.1 Installation

Allow front access to the MBS box at all times for maintenance and servicing. Electrical codes require that the MBS box be installed with no less than 3 feet at the front of the cabinet. Side and rear panels do not require service clearance; however side vents must not be blocked.

Danger!

ALL POWER CONNECTIONS MUST BE COMPLETED BY A LICENSED ELECTRICIAN WHO IS EXPERIENCED IN WIRING THIS TYPE OF EQUIPMENT. WIRING MUST BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES. IMPROPER WIRING MAY CAUSE DEATH, INJURY, EXPLOSION, FIRE OR DAMAGE TO THE EQUIPMENT. VERIFY THAT ALL INCOMING HIGH AND LOW VOLTAGE POWER CIRCUITS ARE DE-ENERGIZED AND LOCKED OUT BEFORE INSTALLING CABLES OR MAKING ANY ELECTRICAL CONNECTIONS.

Refer to Section 2.1, Site Planning and Preparation

Verify the following connections have been made per wiring diagrams: 6001-032-31-S.

Wiring Inspection:

1) Verify all power connections are tight.
2) Verify all control wire terminations are tight.

3) Verify all power wires and connections have proper spacing between exposed surfaces, phase-to-phase and phase-to ground.

4) Verify that all control wires are run in individual, separate steel conduit.

5.1.2 Operation

The external maintenance bypass switch in mounted in a box which is field installed on the unit cabinet. This box includes a rotary switch to provide a single control for transferring to and from maintenance bypass. For ratings, wiring diagram enclosure dimensions and installation refer to drawings # 6001-032-31.

The operator control switch for external manual bypass switch can be accessed by opening the cabinet front door.

Caution **The single control simplifies the operation of the external manual bypass switch, however operating instructions must be carefully observed before using the bypass switch.**

The THREE Manual Bypass Switch Positions are:

1) **"UPS"** – Connects the critical load to the output of the Inverter and establishes normal operation.

2) "SBS" – Connects power to the critical load through Static Bypass Switch (For 0° Phase angle synch)

3) **"BYPASS"** – Connects power to the critical load through the Bypass switch to bypass the Inverter.

5.1.3 Specification. Optional External Manual Bypass Switch

Part Number	Description
3000-044	EXTERNAL MANUAL BYPASS SWITCH, MAKE BEFORE BREAK, 55AMP, 3 POLES / LINE ONLY, 14"(W) x 8.00(D) x 16.00 (H). USE FOR: **3, 5, and 7.5 KVA UNITS**
3000-045	EXTERNAL MANUAL BYPASS SWITCH, MAKE BEFORE BREAK, 110AMP, 3 POLES / LINE ONLY, 14"(W) x 8.00(D) x 16.00 (H). USE FOR: **10, 15, 20 KVA , AND 17 KW UNITS**

5.2 OPTIONAL INTERNAL MANUAL BYPASS SWITCH – P/N 9100-1359-01 THRU -04

5.2.1 Specifications

Part Number	Description
9100-1359-01	FOR: **3, 5, and 7.5 KVA UNITS,** SAME IN/OUT VOLT UNIT).
9100-1359-02	FOR: **3, 5, and 7.5 KVA UNITS,** DIFFERENT IN/OUT VOLT UNIT).
9100-1359-03	FOR: **10, 15, and 15 KVA UNITS, 17KW** SAME IN/OUT VOLT UNIT).
9100-1359-04	FOR: **10, 15, and 15 KVA UNITS, 17 KW** DIFFERENT IN/OUT VOLT UNIT).

5.2.2 Instruction for Internal Maintenance Bypass Switch:

"UPS to BYPASS"

1) Turn Battery Breaker Off

2) Switch Manual Bypass switch to "BYPASS" position.

Note: Leave Battery Breaker Off except when set on "UPS" position Manual Bypass Switch.

"BYPASS to UPS"

1) Turn Battery Breaker Off

2) Switch Manual Bypass switch to "UPS" position.

3) Turn on battery CB for Normal operation.

5.3 OPTIONAL AUDIO ALARM WITH SILENCE SWITCH – P/N 9100-1363-01

5.4 OPTIONAL REMOTE UNIT STATUS PANEL - P/N 9100-1020-06

5.4.1 Installation

The Remote Unit Status Panel is available in a console mount style box in black finish.

It can also be wall mounted and comes with a 10 foot long “DB” connector signal cable or optional length cable that can be up to 1000 feet long.

5.4.2 Operation

Remote Status Panel comes with 10ft long cable, SILENCE, LED / HORN test switches and includes following status LED’s.

- INPUT OK: Input power is within acceptable range
- INVERTER ON: Inverter is On
- ON BYPASS: Unit is on bypass mode
- ON BATT: Unit is running from Battery
- LOW BATT: Battery voltage is at low voltage before shutdown
- SUM ALARM: Unit is on critical alarm such as; Over Temperature, DC OV/UV
- HORN: Audible warning for alarm condition
- SILENCE SWITCH: Silences the audible warning
- LED TEST: Tests the LED’s by push in

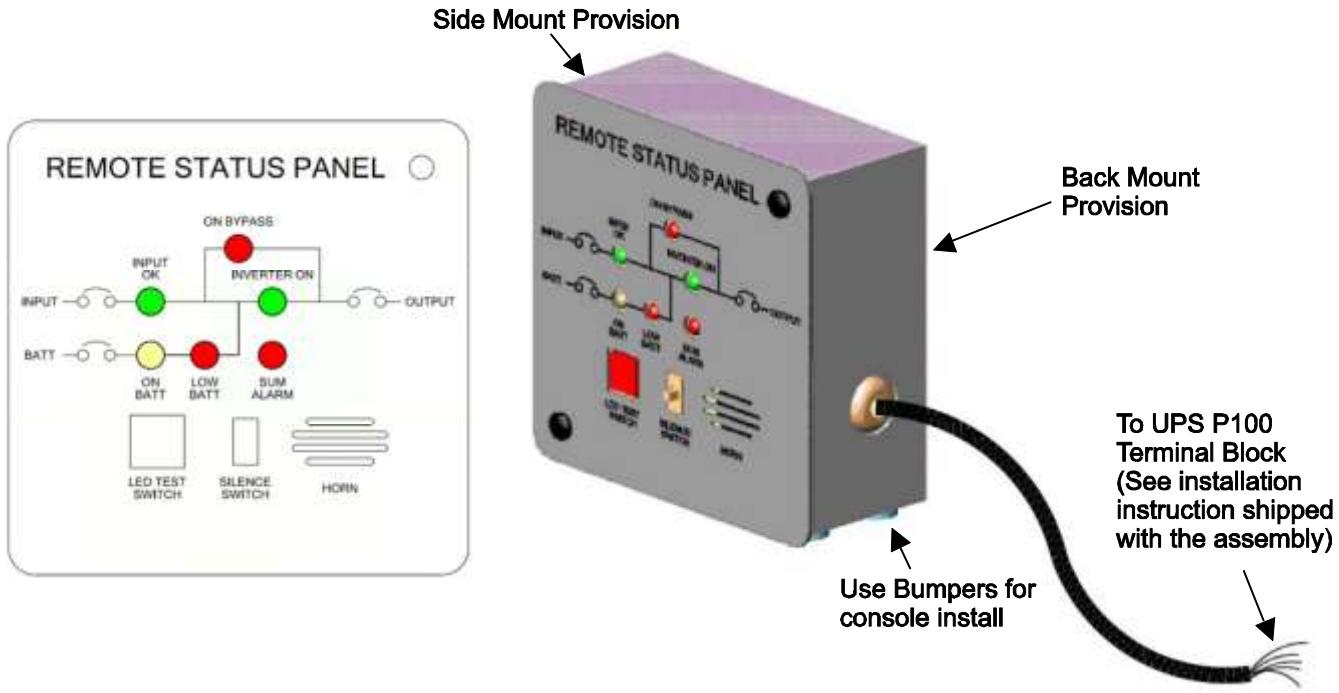


ILLUSTRATION 5-3: REMOTE STATUS PANEL

5.4.3 Specifications

Unit Remote Status Panel Installation Drawing 9100-1020-06, revision A, attached at the end of System Options Section.

5.5 OPTIONAL FORM “C” CONTACTS FOR ALARMS – P/N 9100-1362-01

5.5.1 Installation

Terminal strip TB is provided on the optional alarm relay board for user connection to the individual alarm contacts.

5.5.2 Operation

The Remote Contact Board includes isolated Form C contacts for the following alarm signals:

TB-1	LOW BATTERY
TB-2	ON BYPASS
TB-3	SUMMARY ALARM
TB-4	NOT USED
TB-5	INPUT FAIL
TB-6	COMMON

5.6 OPTIONAL TVSS P/N – 9100-1440-02

5.6.1 Operation

TVSS contains energy absorbing components designed for specific line configurations. The device has two-stage protection. When protection components are damaged by absorbed transients, the device will show a reserve flag indicating a need for replacement. At this time the device is still operational, due to redundant circuits. After the second spike, the device will show and alarm condition indicating replacement is mandatory. Remote indication contacts "TS" allows remote control of the protection status.

5.7 OPTIONAL NORMALLY ON/ NORMALLY OFF OUTPUT AUX. CIRCUIT BREAKERS – P/N 9100-1343-01 THRU –16

These circuit breakers are 1 pole, 20A devices for protection of customer's circuits.

Normally ON C.B. Option
Normally OFF C.B. Option
Normally OFF Delay C.B. Option

NORM ON/OFF OUTPUT AUX. CBS, STANDARD KAIC CB. Refer to the table for details in the separate attachment. 10 KAIC @ 120/240 VOLT, 6 KAIC @ 277 VOLT.

5.8 OPTIONAL EXTERNAL OUTPUT AUX. CIRCUIT BREAKERS IN PANEL BOARD – P/N 9100-1439-01 THRU -03

5.8.1 Description

A matching external panel board with 1P 20A, (QO-Square D) circuit breakers is provided for power distribution from the unit output to critical loads. The panel board accommodates up to 42 breakers. A main circuit breaker is provided with each panel board. See drawing 6001-03-15 for panel mounting arrangement.

5.8.2 Specification

Part Number	Description
9100-1439-01	EXTERNAL OUTPUT AUX CBS OPTION IN A PANEL BOARD 1PH, CB. UP TO 24 (QO BREAKER) 125AMP.
9100-1439-02	EXTERNAL OUTPUT AUX CBS OPTION IN A PANEL BOARD 1PH, CB. UP TO 30 (QO BREAKER) 200AMP.
9100-1439-03	EXTERNAL OUTPUT AUX CBS OPTION IN A PANEL BOARD 1PH, CB. UP TO 42 (QO BREAKER) 225AMP.
2025-125	10KAIC @240V, 120/240V, APPLICATION CB, 1PH, 20AMP QO BREAKER FOR 9100-1439-xx.

5.9 OPTIONAL HIGHER KAIC NORM ON/OFF OUTPUT CIRCUIT BREAKER

HIGHER KAIC NORMALLY ON/NORMALLY OFF OUTPUT AUX CBs OPTION, 1-PHASE, 20AMP

Part Number	Description
9100-1434-31~-56	42 KAIC @120/240V, Din Rail
9100-1434-61~-86	65 KAIC @208/240V ONLY. Din Rail
9100-1435-01~-26	14 KAIC @277V ONLY. Molded Case C.B.
9100-1435-61~-86	65 KAIC @277V ONLY. Molded Case C.B.

5.10 OPTIONAL INPUT CB STANDARD / HIGHER KAIC

INPUT CIRCUIT BREAKER OPTION, STANDARD AND HIGHER KAIC

Refer to the separate table in Appendix "C"

5.11 OPTIONAL OUTPUT CB STANDARD / HIGHER KAIC

OUTPUT CIRCUIT BREAKER OPTION, STANDARD AND HIGHER KAIC
Refer to the separate table in Appendix “C”

5.12 OPTIONAL SEISMIC MOUNTING BRACKET – P/N 9100-1317-02

Left / Right seismic floor mounting bracket, 1 set per cabinet.

5.13 OPTIONAL STACKABLE RACK – P/N 9100-1429-XX

Drawings: 6001-033-02. (One rack per 2 cabinets)

5.14 OPTIONAL POWER FLOW MIMIC – P/N 9100-1493-02 (illustration 5-4)

5.14.1 Operation

Power Flow Mimic allows unit power status verification at-a-glance. It has 6 LED’s indicating the following conditions: GREEN – Input OK, GREEN – Inverter On, YELLOW – On Battery, YELLOW – On Bypass, RED – Low Battery, RED – Summary Alarm. The LED’s are located on the pictogram below for quick status assessment.

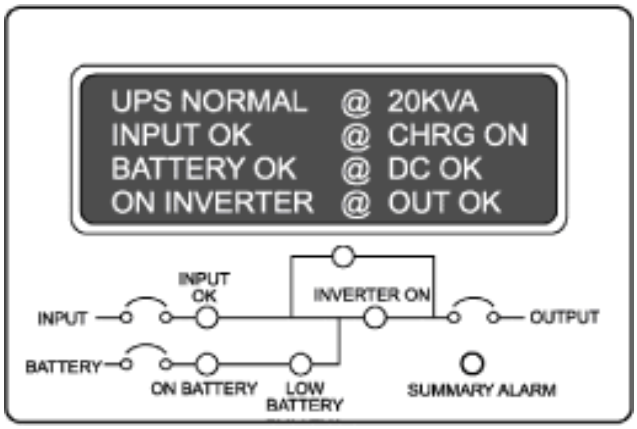


ILLUSTRATION 5-4: MIMIC PAD

5.14.2 Specification

Description:	POWER FLOW MIMIC OPTION – 1 PHASE
Part Number:	9100-1493-02
Color:	Blue with black lettering
Dimensions:	4.25” x 4”
Mounting:	Self-adhesive Scotch pad
LED’s:	Water clear lens, 20 mA, View Angle 140. Nicom.ZU55W-05,
Connectors:	Nicomatic 8 Pin, Black

5.15 OPTIONAL GMS – GLOBAL MONITORING SYSTEM, LOCAL ON UPS

5.15.1 Local On UPS - EVENT LOG

5.15.1.1 Operation

Control and Monitoring PCB acquires event data and displays up to 100 most recent Date and Time stamped events. The default setting is a scroll of monitoring and alarm screens. When the log is full, the first (oldest) events is erased from the register. System events are in Appendix B.

Key pad functions and resulting screens are presented below:

LOG – Press one time to activate the event log display. After approximately 5-seconds, the screen will show the event log. All stored events will be continuously scrolled on display. Press Log once again to return to the main menu.

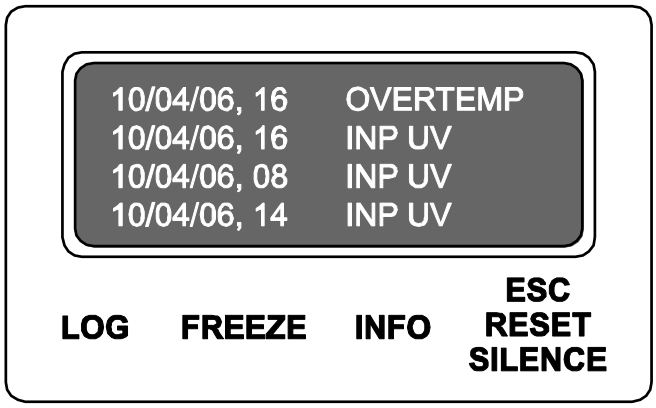


ILLUSTRATION 5-5: LOGGED EVENTS

FREEZE – Press one time. The display will freeze the default monitoring and alarms screen. Press the Freeze key again to return the display to the initial menu with scrolling operation.

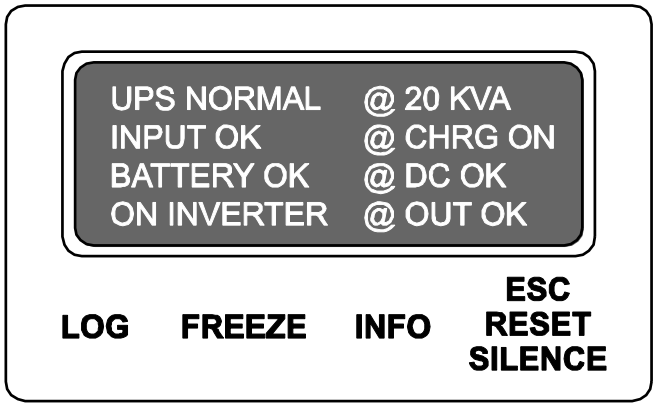


ILLUSTRATION 5-6: STATUS SCREEN

INFO – Press the key one time. System data appears on the screen after few seconds. Pressing the key once again returns the display to default screen.

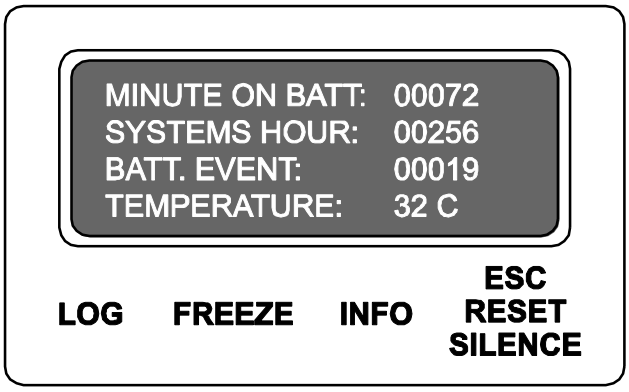


ILLUSTRATION 5-7: SYSTEM INFO

RESET – Pressing the "Reset" and "Info" keys together clears.

5.15.1.2 Specification

Description: Local On UPS - Event Log
Part Number: 9100-1466-01/9100-1538-XX
Components:
Monitoring PCBA: P/N 1625-344-01
Power Supply: P/N 1625-339, 5, 12 VDC, 25W
Com Cable: P/N 7060-1187-01
Keypad Overlay: P/N 1250-070

5.15.2 Local On UPS - Aux CB's Trip Monitor – P/N 9100-1453-01

5.15.2.1 Operation

Trip signals coming from the breakers are displayed on the circuit breaker trip screen. The circuit breaker is a part of default monitoring and alarm display, that scrolls continuously when the unit is in operation. Below is an illustration of a typical circuit breaker trip screen.

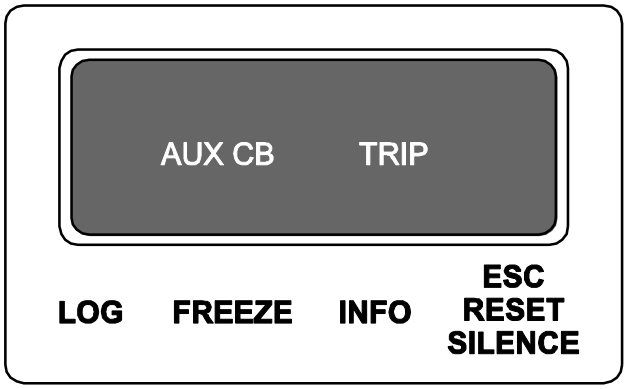


ILLUSTRATION 5-8: AUXILLIARY CB TRIP

5.15.2.2 Specification

Description: Local On UPS – Aux. CB'S Trip Monitor With Event Log
Part Number: 9100-1453-01
Components:
Event Log Option – P/N 9100-1466-01
Trip monitoring modules: ABB S2C-S/H 6R, DIN rail mount
Monitored CBs: only ABB MCB series

5.15.3 Local On PC – Via RS 232 – P/N 9800-01 – 25 THRU 150 (25-150ft)

5.15.3.1 Description

This option requires a PC and LabView monitoring software. The software is provided on a disc that is easily installed on any Windows platform. An attached cable of a specified length plugs into a PC serial port and connector J6 on the Control PCB 1625-296.

LabView software must selected for COM port 1.

5.15.3.2 Operation

LabView software translates data protocol coming to COM port from an active unit via the RS232/RS485 Interface and displays the parameters and active alarms on a PC monitor in the appropriate form. Below is a sample of a PC screen with measured parameters and actual unit status.

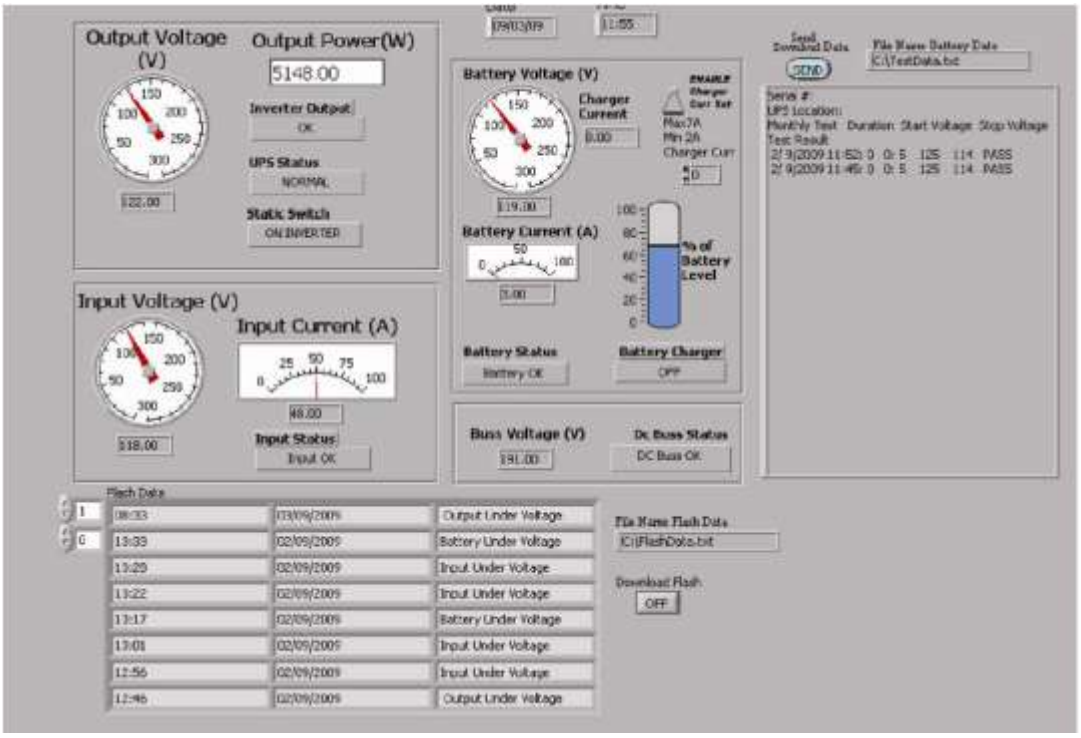


ILLUSTRATION 5-9: SAMPLE PC SCREEN

5.15.3.3 Specification

Description: Local On PC – Via RS 232
Part Number: 9800-005-XX
PC system requirements: 98 and higher Windows OS, serial port.
Viewing software: Lab View, included
RS232 cable: 25 thru 15-ft, as specified, included

5.15.4 Local On PC – Via RS 485 – P/N 9800-006-01

Installation, Operation, Specification as above (except RS 485 cable)

5.16 OPTIONAL ECC – EMERGENCY CIRCUIT CONVERTER – P/N 9100-1501

5.16.1 Installation

Indoor use only. Simple and fast installation in ceiling or wall mounted standard single gang E-box. Installation must be performed by a qualified electrician per Installation, Operation and Maintenance Instructions, provided with the ECC.

5.16.2 Operation

When used with an inverter system, the ECC is designed to allow you the ability to turn off ALL of the lighting in a given area via the local switch, and still provide emergency lighting during a power failure. The device will provide single phase power from the emergency source to the designated emergency fixtures regardless of their current status (on or off), thereby insuring safe egress from the facility at all times. The automatic Diagnostic feature will confirm the emergency system is ready to provide back up power.

5.16.3 Specification

Description:	ECC – EMERGENCY CIRCUIT CONVERTER OPTION
Part Number:	9100-1501-01 – 120 VAC
	9100-1501-02 – 277 VAC
Rating:	120 VAC – 20 A Ballast load, 1000 W Tungsten Lamp load, 20 A, 1 HP
	277 VAC – 20 A Ballast load, 1800 W Tungsten Lamp load, 20 A, 1.5 HP
Operating Temperature:	20 to 150 F
Flame rating:	UL 94V-O
Size:	2.75"W x 4.75"H x 1.75"D (overall)
	Low profile – recessed portion is only 1.5" deep
Color:	White
Weight:	8 oz.

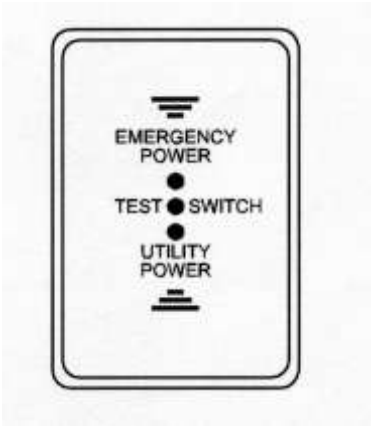


ILLUSTRATION 5-10: ECC EMERGENCY CIRCUIT CONVERTER

5.17 OPTIONAL ECM – EMERGENCY CONTROL MODULE – P/N 9100-1502

5.17.1 INSTALLATION

Indoor use only> ECM is a universal mount unit. simple and fast installation in ceiling or wall mounted standard single gang E-box, recommended box size 4". Installation must be performed by a qualified electrician per Installation, Operation and dMaintenance Instructions provided with the EMC.

5.17.2 Operation

The emergency power is provided from a central lighting inverter that is automatically switched over to 24 hour emergency power distribution panel. The room switch turns on and off both regular and emergency lights simultaneously. This is accomplished by having the room switch leg power activate the Emergency Control Module. Wire input#1 is connected internally to a sensing circuit. During a power interruption, this circuit causes contact X to drop into a N.C. position. Please review wiring schematics.

5.17.3 Specification

Description:	ECM – EMERGENCY CONTROL MODULE
Part Number:	9100-1502-01 – 120 VAC
	9100-1502-02 – 277 VAC
Rating:	Maximum Ballast load 1500 W, 120 and 277 VAC
	20 A N.C. UL contact rating
	High Voltage surge protectors
Approvals:	UL 924, NFPA 1104-2.4.1, OSHA
	NEC 700 thru 700-26, 701-717, 702-709, 705-750
Operating Temperature:	210 to 150 F
Size:	2.75"W x 1.5"H x 1.25"D (overall)
Color:	Black
Weight:	8 oz.

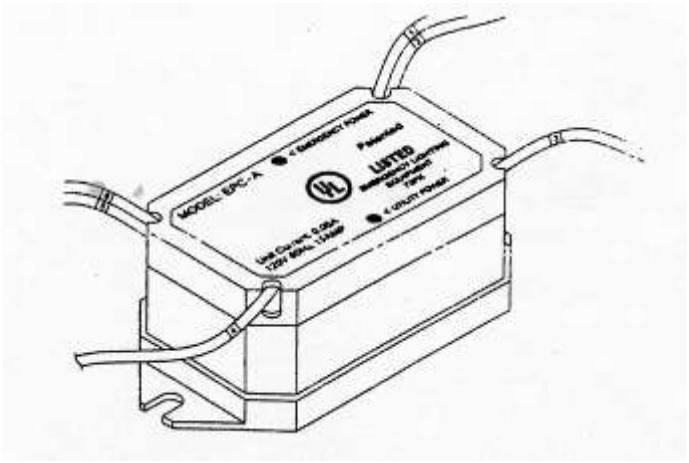


ILLUSTRATION 5-11: ECM EMERGENCY CONTROL MODULE

5.18 "OFF-Line Inverter operation"

5.18.1 Slow transfer unit, P/N 9100-1473-01.

5.18.2 Fast transfer unit, P/N 9100-1634-01 thru -14.

SECTION 6 – MAINTENANCE

6.1 SAFETY PRECAUTIONS

Danger!

READ AND UNDERSTAND THIS SECTION THOROUGHLY BEFORE PERFORMING ANY MAINTENANCE WORK ON OR AROUND THE UNIT. READ THE BATTERY MANUFACTURER'S MANUAL AND MATERIAL SAFETY DATA SHEETS BEFORE WORKING ON OR NEAR THE BATTERIES.

ONLY NORMAL SAFETY PRECAUTIONS ARE REQUIRED WHEN THE UNIT IS OPERATING WITH ALL CABINET DOORS CLOSED. HOWEVER, THE UNIT AND BATTERY CABINETS MUST BE KEPT FREE OF STANDING PUDDLES OF WATER, EXCESS MOISTURE, OR DEBRIS. DEBRIS CAN CONSIST OF EXCESSIVE DUST IN AND AROUND THE UNIT, AS THE COOLING FANS IN THE UNIT WILL PULL THIS DUST INTO THE UNIT.

Danger!

ONLY FACTORY TRAINED OR AUTHORIZED PERSONNEL SHOULD ATTEMPT TO INSTALL OR REPAIR THE UNIT OR ITS BATTERY SYSTEM. IMPROPER INSTALLATION HAS PROVEN TO BE THE SINGLE MOST SIGNIFICANT CAUSE OF START-UP PROBLEMS. SERVICE PERSONNEL SHOULD WEAR INSULATING SHOES FOR ISOLATION FROM DIRECT CONTACT WITH THE FLOOR (EARTH GROUND), AND SHOULD MAKE USE OF RUBBER MATS WHEN PERFORMING MAINTENANCE ON ANY PORTION OF THE UNIT WHILE IT IS UNDER POWER. HIGH AC AND DC ELECTRICAL VOLTAGES ARE PRESENT THROUGHOUT THE UNIT(S) AND INCORRECT INSTALLATION OR SERVICING COULD RESULT IN ELECTROCUTION, FIRE, EXPLOSION, OR EQUIPMENT FAILURE.

Danger!

SPECIAL SAFETY PRECAUTIONS AND LOCKOUT TAGOUT PROCEDURES ARE REQUIRED FOR ALL OPERATIONS INVOLVING THE HANDLING, INSTALLATION, OR MAINTENANCE OF THE UNIT SYSTEM AND ANY ASSOCIATED BATTERY CABINETS. FAILURE TO FOLLOW SAFETY PROCEDURES COULD RESULT IN DEATH, INJURY OR DAMAGE TO EOUIPMENT.

Danger!

THIS EQUIPMENT CONTAINS CIRCUITS THAT ARE ENERGIZED WITH HIGH VOLTAGES. ONLY TEST EQUIPMENT DESIGNED FOR TROUBLESHOOTING HIGH VOLTAGES SHOULD BE USED, PARTICULARLY FOR OSCILLOSCOPES AND PROBES.

ALWAYS CHECK WITH AN AC AND DC VOLTMETER TO ENSURE SAFETY BEFORE INITIATING CONTACT OR USING TOOLS. EVEN WHEN THE POWER IS OFF, DANGEROUSLY HIGH POTENTIAL VOLTAGES MAY EXIST AT CAPACITOR BANKS. ALWAYS OBSERVE BATTERY PRECAUTIONS WHEN OPERATING NEAR ANY BATTERIES.

FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN DEATH, INJURY OR DAMAGE TO EQUIPMENT.

Danger!

OBSERVE ALL BATTERY SAFETY PRECAUTIONS DURING INSTALLATION OR SERVICE OF THE UNIT OR BATTERIES. EVEN WITH THE BATTERY CIRCUIT BREAKER IN THE OFF POSITION, THE DANGER OF ELECTROCUTION MAY STILL BE PRESENT. THE BATTERY POWER TO THE UNIT MUST BE LOCKED AND TAGGED "OFF" BEFORE PERFORMING ANY SERVICE OR WORK ON THE UNIT. THE BATTERY MANUFACTURER'S SAFETY INFORMATION AND MATERIAL SAFETY DATA SHEET IS LOCATED IN A POCKET ATTACHED TO THE INSIDE OF LEFT DOOR OF EACH UNIT. FAILURE TO FOLLOW THOSE INSTRUCTIONS AND THE INSTRUCTION LISTED ABOVE AND ELSEWHERE IN THIS MANUAL COULD RESULT IN AN EXPLOSION, FIRE, EQUIPMENT FAILURE, OR ELECTROCUTION.

Danger!

BE CONSTANTLY AWARE THAT THE UNIT SYSTEM CONTAINS HIGH DC AS WELL AS AC VOLTAGES. WITH INPUT POWER OFF AND THE BATTERY, DISCONNECTED, HIGH VOLTAGE AT THE FILTER CAPACITORS AND POWER CIRCUITS SHOULD DISCHARGE WITHIN 30 SECONDS. HOWEVER, POWER CIRCUIT FAILURES CAN OCCUR, SO YOU SHOULD ALWAYS ASSUME THAT HIGH VOLTAGE MIGHT STILL EXIST AFTER SHUTDOWN. VERIFY THAT POWER IS OFF USING AC AND DC VOLTMETERS BEFORE MAKING CONTACT.

6.2 WHEN TO CALL

Call for service if you encounter any of the following conditions:

1) Repeated start-up attempts are unsuccessful.
2) A UPS fault occurs which cannot be cleared.
3) Normal operation of the critical load repeatedly causes an overload condition. This is not a unit fault but a qualified person must analyze the total load connected to the unit to prevent unit failure. Momentary overload conditions will be handled within the parameters of the Unit but sustained overloads will cause the Unit to fail.
4) Any indicators or alarms operate abnormally or continuously.
5) Any other abnormal function of the system occurs.
6) If any abnormal battery condition is detected.
7) When you are unsure of what action to take.

6.3 STEPS TO TAKE

If any of the above occur:

1) Consult Appendix C, LCD Display Menu and Troubleshooting Guide. Record information on the LCD Display to relay to Crucial Power Customer Service and Support.
2) Call Crucial Power Customer Support at 1-800-797-7782 or 1-800-PWR-SRVC.

Danger!

LETHAL VOLTAGES ARE PRESENT INSIDE THE EQUIPMENT EVEN WHEN THERE APPEARS TO BE NO INPUT POWER TO THE UNIT. PROTECT YOURSELF FROM THE RISK ELECTROCUITION BY REFERRING SERVICE TO QUALIFIED PERSONNEL ONLY.

6.4 PREVENTATIVE MAINTENANCE

Unit Operator Maintenance consists of the basic tasks listed in this section. Other maintenance functions require Crucial Power Service personnel.

6.4.1 Maintaining an Operator's Log

Careful record keeping will ensure proper maintenance of the Unit, and assist in the correction of any abnormal conditions.

The operator's log should contain the following information:

Date of system start-up

Dates that battery maintenance was performed

Dates that input, output, and battery status readings were checked and the values displayed for these readings.

Dates and summaries of all communications with Crucial Power Service Personnel.

6.4.2 Periodic Testing of Unit

The Unit should be manually exercised on a periodic basis (once every three months, for example). This forces the unit to transfer to the battery and return to main power. This process activates self-diagnostic testing which may reveal conditions that require attention.

6.4.3 Maintaining the Batteries

Danger!

BATTERY CIRCUIT BREAKER OPERATES AT THE RATED BATTERY VOLTAGES AT ALL TIMES. TRIPPED BATTERY CIRCUIT BREAKER INDICATES A SERIOUS PROBLEM THAT MAY RESULT IN SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT IF CLOSE THE CIRCUIT BREAKER WITHOUT KNOWING WHY IT FAILED. CHECK SHORT IN BATTERY OR CALL CRUCIAL POWER PRODUCTS CUSTOMER SERVICE AND SUPPORT FOR ASSISTANCE AT 1-800-PWR-SRVC.

Danger!

THE BATTERY ELECTROLYTE IS A DILUTED SULFURIC ACID THAT IS HARMFUL TO THE SKIN AND EYES. IT IS ELECTRICALLY CONDUCTIVE AND CORROSIVE. WEAR FULL EYE AND HAND PROTECTION ALONG WITH PROTECTIVE CLOTHING. IF THE ELECTROLYTE CONTACTS THE SKIN, WASH IT OFF IMMEDIATELY WITH WATER. IF ELECTROLYE CONTACTS THE EYES, FLUSH THOROUGHLY AND IMMEDIATELY WITH WATER. SEEK IMMEDIATE MEDICAL ATTENTION. SPILLED ELECTROLYTE SHOULD BE WASHED DOWN WITH A SUITABLE ACID NEUTRALIZING AGENT. ONE COMMON PRACTICE IS TO USE A SOLUTION OF APPROXIMATELY ONE POUND (450 GRAMS) OF BICARBONATE OF SODA TO APPROXIMATELY ONE GALLON (4 LITERS) OF WATER. THE BICARBONATE OF SODA SOLUTION SHOULD BE APPLIED TO THE SPILL UNTIL EVIDENCE OF CHEMICAL REACTION (FOAMING) HAS CEASED. THE RESULTING LIQUID SHOULD BE FLUSHED WITH WATER AND THE AREA DRIED.

Danger!

DO NOT DISPOSE OF A BATTERY OR BATTERIES IN A FIRE. THE BATTERIES MAY EXPLODE CAUSING DEATH OR SERIOUS INJURY.

Caution **Do not substitute batteries from other manufacturers without the express approval of Crucial Power Customer Service personnel.**

- **Power Battery PRC-12xxx is one battery manufacturer used by Crucial Power, with xxx representing the amp-hour size of the battery.**
- **Universal Battery UB12xxx is another battery manufacturer authorized by Crucial Power, the xxx is the amp-hour size of battery.**

Caution **Lead-acid batteries contain hazardous materials and must be handled, transported, and recycled or scrapped in accordance with federal, state, and local regulations. Since lead is a toxic substance, lead-acid batteries should be recycled rather than scrapped.**

Caution **A battery can present a risk of electrical short and high short circuit current. The following precautions should be observed when working on or around batteries:**

- **Remove watches, rings, necklaces, or other metal objects.**
- **Use only tools with insulated handles.**
- **Wear rubber insulating gloves and boots.**
- **Do not lay tools or metal parts on top of batteries.**
- **Disconnect charging source prior to connecting or disconnecting battery terminals.**
- **Verify that batteries are properly grounded.**

Danger!

DO NOT GROUND BATTERY POSITIVE OR NEGATIVE.

Caution **Lead-acid batteries can present a risk of fire because they generate hydrogen gas. The following safety procedures must be followed:**

- **DO NOT SMOKE when near batteries.**
- **DO NOT cause flame or sparks in battery areas.**
- **Discharge static electricity from your body before touching batteries by first touching a grounded metal surface.**

Caution **When replacing batteries, use with the same number of batteries, and same manufacturer, type, and model that was supplied with the unit. To avoid system failure, replace all batteries if one or more batteries fail to perform to specifications.**

6.4.4 Battery Cabinets

Although the individual batteries are sealed and require minimal maintenance only, the batteries should be given a periodic inspection and electrical check every six months.

Battery Service Agreements are available through Crucial Power Customer Service and Support at 1-800-PWR-SRVC (800-797-7782).

In order to qualify for battery warranty replacement, you will need to show records of the battery maintenance history including battery numbers, battery voltages (individual cells), terminal torque measurements and dates of maintenance.

6.4.5 Power Connections

Check for corrosion and connection integrity. Visually inspect wiring for discolored or cracked insulation. Clean and / or re-torque as required.

All Battery terminal connections must be tighten with proper torque value set in accordance with the table or instructions provided by battery manufacturer.

Use the correct torque tool to tighten the terminal bolts as indicated in table below and use all hardware's provided with batteries.

Type – Standard VRLA Battery

Battery part number	Initial torque in LBS	Annual re-torque in LBS	Terminal Type	Hardware
PRC-12150 C (150AH)	120 IN-LB / 13.6 NM	115 IN-LB / 13.6 NM	Copper Insert Terminal	¼ - 20 UNC Bolt
UB 12750	88.5 IN-LB / 10 NM	84 IN-LB / 9.5 NM	Z1 "Z" post type terminal	1 to 1.25" long bolt w/14mm head, 14mm nut, 8mm washer & lock washer
UB12900	88.5 IN-LB / 10 NM	84 IN-LB / 9.5 NM	Same as above	Same as above
UB12110	88.5 IN-LB / 10 NM	84 IN-LB / 9.5 NM	Same as above	Same as above

Type G – Longer warranty battery

Battery part number	Initial torque in LBS	Annual re-torque in LBS	Terminal Type	Hardware
GSLF – 10512	120 IN-LB / 13.6 NM	115 IN-LB / 13.0 NM	Copper Insert	¼ "
GSLF - 12012	120 IN-LB / 13.6 NM	115 IN-LB / 13.0 NM	Copper Insert	¼ "

Type N – Nickel-Cad battery (only nickel plated copper cable lugs should be used).

Ni-Cad P/N	Recommended Torque		Bolt Diameter
BM 112/ 138	66 IN-LB	7.5 NM	M5
BM 148/ 184	177 IN-LB	20 NM	M8
BM 195/231/277	266 IN-LB	30 NM	M10
NOTE: For annual re-torque; reduce 5 IN-LB from recommended torque value.			

Caution **Torque all connections in accordance with the above tables unless provided from battery manufacturer. Failure to do so may create an unsafe condition or fire hazard.**

6.4.6 Battery Terminals

- Check for discoloration, corrosion and connection integrity. Clean and tighten as necessary.
- To access battery terminals, remove the top strapping material located at the lower front of the battery shelf. Pull the battery forward to access the battery connections. Disconnect the cables connected to the battery. Once disconnected, insulate the cables to prevent accidental shorts (Use a protective boot or electrical tape). Before replacing the battery connections, clean and re-torque the connection hardware.
- Crucial Power Customer Service personnel must approve use of non-standard batteries. Please call at 1-800-PWR-SRVC (800-797-7782).

6.5 CRUCIAL POWER CUSTOMER SERVICE AND SUPPORT

Start-up, unit maintenance, battery maintenance, and preventative maintenance programs are available through your Crucial Power sales representative or through Crucial Power Customer Service and Support. A program of periodic **maintenance is recommended once every six months**, but is mandatory once every twelve months since heat and cold will effect the compression of the electrical connections and lack of maintenance will shorten the product's life expectancy possibly causing unsafe operating condition.

6.5.1 Start-Up Services

Various start-up services are available. See your sales representative or telephone Crucial Power Customer Service at 1-800-PWR-SRVC (800-797-7782).

6.5.2 Maintenance Agreements

Standard Full Service, 24/7 Full Service, and Extended On or OFF Site Maintenance agreements are available. See your sales representative or telephone Crucial Power Customer Service at 1-800-PWR-SRVC (800-797-7782).

6.5.3 Warranties

Contact Crucial Power Customer Service and Support at 1-800-PWR-SRVC (800-797-7782) if you have any questions regarding the warranty on your unit, system or batteries.

APPENDIX A – SPECIFICATIONS

SPECIFICATIONS FOR KVA, 0.7PF UNITS

POWER RATING (KVA/KW)	3 / 2.1	5 / 3.5	7.5 / 5.25	10 / 7	12.5 / 8.75	15 / 10.5	20 / 14
INPUT							
VOLTAGE (VAC)	Single Phase, 120/208/240/277 VAC		Single Phase, 208/240/277 VAC				
MAXIMUM CURRENT	29/17/15/13	44/25/22/19	36/30/26	74/40/35	57/49/43	68/59/51	89/77/66
TOLERANCE	+15% to -15%						
FREQUENCY (Hz)	60 +/- 3%						
POWER FACTOR	0.98 to 1.0 (Typical)						
OVERCURRENT PROTECTION	Electronic / Circuit Breaker						
NUMBER OF WIRES	2 Wires plus Ground						
POWER CONNECTION	Hard Wired (Terminal Block)						
OUTPUT							
RATING (KVA/KW)	3 / 2.1	5 / 3.5	7.5 / 5.25	10 / 7	12.5 / 8.75	15 / 10.5	20/14
VOLTAGE (VAC)	Single Phase, 120/208/240/277 VAC						
VOLTAGE REGULATION	+/-3% No Load to Full Load; +/-3% High Line to Low Line						
FREQUENCY (Hz)	60 Hz +/-0.25 Hz (When on Inverter)						
WAVESHAPE	Sine Wave						
HARMONIC DISTORTION	<5% THD; <3% Single Harmonic						
CREST FACTOR	Up to 3 to 1						
POWER FACTOR	0.65 Lagging or Leading to Unity						
STEADY-STATE CURRENT	18/10/9/8	29/17/15/13	44/25/22/19	58/34/29/25	73/4236/32	88/50/44/38	96/83/72
OVERLOAD	125 % for One (1) minutes, surge 150 %						
PROTECTION	Electronic / Circuit Breaker						
NOISE REJECTION	-120 dB Common Mode; -60 dB Normal Mode						
NUMBER OF WIRES	2 Wires plus Ground						
POWER CONNECTION	Hard Wired (Terminal Block)						

POWER RATING (KVA)	3 / 2.1	5 / 3.5	7.5 / 5.25	10 / 7	12.5 / 8.75	15 / 10.5	20 / 14
BATTERY							
BATTERY RUN TIME	90 Minutes Minimum						
BATTERY TYPE	Sealed, Maintenance-Free, AGM, VRLA type						
NOMINAL DC VOLTAGE	96 VDC	120 VDC	120 VDC	192 VDC	192 VDC	240 VDC	
OVERCURRENT PROTECTION	Circuit Breaker						
PACKAGING	Batteries Housed in Same Enclosure and/or additional battery cabinet (See Table 2-1)						
MONITORING AND COMMUNICATIONS							
LCD SCREEN	Input Voltage; Battery Charger; UPS Output; On Battery; Low Battery; Summary Alarm						
INDICATORS	LCD Display Panel						
RELAY INTERFACE	Dry Contacts for: UPS On (N.C.); On Inverter (N.O.); Loss of Input Power (N.O.); Low Battery (N.O.)						
CONTACT RATING	125 Volts (AC or DC) Maximum; 1.25 Amperes Maximum; 30 Watts / 50 VA Maximum						
INTERFACE CONNECTION	Hard Wired (Terminal Block)						
ENVIRONMENTAL							
USRGE WITHSTANDABILITY	ANSI C62.41-1980 Categories A & B						
OPERATING TEMPERATURE	Meets NEMA Requirements						
OPERATING RELATIVE HUMIDITY	0 to 95% Non-Condensing						
ALTITUDE	Up to 6,000 Feet (1,829 Meters) with No De-Rating						
COOLING	Air Cooled-Forced Fan						
PHYSICAL							
SIZE H x W x D in. (cm)	70 x 39 x 20 (177.8 x 99.1 x 50.8)						
WEIGHT lbs (kg) with batteries	896 (408)	1191(533)	1666 (758)	2042 (929)	3572 (1625)	3132 (1425)	4732 (2153)
CONSTRUCTION	Painted Steel Enclosure with 3 Point Double Locking Front Door; and Full-Length Door Hinge.						
ENCLOSURE	Designed for Inside Installations						
COLOR	Natural finish						
ACCESSIBILITY	Front - All Servicing is Through the Front; No Side or Rear Access is Required.						
CABLE ENTRY	Bottom or sides						
MOUNTING	Four (4) Holes Provided to Anchor Enclosure to Pedestal (Supplied by Others)						

Crucial Power Products

SPECIFICATIONS FOR KW, 1.0PF UNITS

POWER RATING (KW)	**3 / 3**	**5 / 5**	**7.5 / 7.5**	**10 / 10**	**12.5 / 12.5**	**15 / 15 20 / 14**	**17**
INPUT							
VOLTAGE (VAC)	Single Phase, 120/208/240/277 VAC		Single Phase, 208/240/277 VAC				
MAXIMUM CURRENT	40/23/20/17	60/35/30/26	51/41/36	64/56/48	79/69/59	95/83/71	107/94/80
TOLERANCE	+15% to -15%						
FREQUENCY (Hz)	60 +/- 3%						
POWER FACTOR	0.98 to 1.0 (Typical)						
OVERCURRENT PROTECTION	Electronic / Circuit Breaker						
NUMBER OF WIRES	2 Wires plus Ground						
POWER CONNECTION	Hard Wired (Terminal Block)						
OUTPUT							
RATING (KVA/KW)	3 / 3	5 / 5	7.5 / 7.5	10 / 10	12.5 / 12.5	15 / 15	17/17
VOLTAGE(VAC)	Single Phase, 120/208/240/277 VAC						
VOLTAGE REGULATION	+/-3% No Load to Full Load; +/-3% High Line to Low Line						
FREQUENCY (Hz)	60 Hz +/-0.25 Hz (When on Inverter)						
WAVESHAPE	Sine Wave						
HARMONIC DISTORTION	<5% THD; <3% Single Harmonic						
CREST FACTOR	Up to 3 to 1						
POWER FACTOR	0.65 Lagging or Leading to Unity						
STEADY-STATE CURRENT (Normal Mode / Emergency Mode)	25/14/13/11	42/24/21/18	63/36/31/27	83/48/42/36	104/60/52/45	125/72/63/54	142/82/91/61
OVERLOAD	125 % for One (1) minutes, surge 150 %						
PROTECTION	Electronic / Circuit Breaker						
NOISE REJECTION	-120 dB Common Mode; -60 dB Normal Mode						
NUMBER OF WIRES	2 Wires plus Ground						
POWER CONNECTION	Hard Wired (Terminal Block)						

POWER RATING (KW)	3 / 3	5 / 5	7.5 / 7.5	10 / 10	12.5 / 12.5	15 / 15	17
BATTERY							
BATTERY RUN TIME	90 Minutes Minimum						
BATTERY TYPE	Sealed, Maintenance-Free, AGM, VRLA type						
NOMINAL DC VOLTAGE	96 VDC	120 VDC	120 VDC	192 VDC	192 VDC	240 VDC	240 VDC
OVERCURRENT PROTECTION	Circuit Breaker						
PACKAGING	Batteries Housed in Same Enclosure and/or additional battery cabinet (See Table 2-2)						
MONITORING AND COMMUNICATIONS							
LCD SCREEN	Input Voltage; Battery Charger; UPS Output; On Battery; Low Battery; Summary Alarm						
INDICATORS	LCD Display Panel						
RELAY INTERFACE	Dry Contacts for: UPS On (N.C.); On Inverter (N.O.); Loss of Input Power (N.O.); Low Battery (N.O.)						
CONTACT RATING	125 Volts (AC or DC) Maximum; 1.25 Amperes Maximum; 30 Watts / 50 VA Maximum						
INTERFACE CONNECTION	Hard Wired (Terminal Block)						
ENVIRONMENTAL							
USRGE WITHSTANDABILITY	ANSI C62.41-1980 Categories A & B						
OPERATING TEMPERATURE	Meets NEMA Requirements						
OPERATING RELATIVE HUMIDITY	0 to 95% Non-Condensing						
ALTITUDE	Up to 6,000 Feet (1,829 Meters) with No De-Rating						
COOLING	Air Cooled-Forced Fan						
PHYSICAL							
SIZE HxWxD in. (cm)	70 x 39 x 20 (177.8 x 99.1 x 50.8)						
WEIGHT lbs (kg) with batteries	1066 (485)	1284 (584)	2350 (1069)	2870 (1306)	3777 (1719)	4512 (2053)	4512/2053
CONSTRUCTION	Painted Steel Enclosure with 3 Point Double Locking Front Door; and Full-Length Door Hinge.						
ENCLOSURE	Designed for Inside Installations						
COLOR	Natural finish						
ACCESSIBILITY	Front - All Servicing is Through the Front; No Side or Rear Access is Required.						
CABLE ENTRY	Bottom or sides						
MOUNTING	Four (4) Holes Provided to Anchor Enclosure to Pedestal (Supplied by Others)						

APPENDIX B - LCD DISPLAY MENU AND TROUBLESHOOTING GUIDE

Two screens (A, B) are updated continuously for units without optional output transformer.

Three screens (A, B, C) are updated continuously for units with optional output transformer.

Start-up Screen

When input power is applied for the unit, LCD panel lights up and displays

Crucial Power UNIT

If LCD display panel is not lit, the unit has problem. Contact the factory service at 1-800-PWR-SRVC (800-797-7782).

Screen A: The first default screen appears as below

UNIT NORMAL @ XX KVA INPUT OK @ CHRG ON BATTERY OK @ DC OK ON INVERTER @ OUT OK

The display may say:

Line 1: UPS NORMAL @ 15 KVA

5 KVA indicates the KVA rating, STAND BY or NORMAL indicating normal operating modes. STAND BY ALARM FAILURE indicates UPS alarm condition and FAILURE indicates unit failed or had persistent alarm condition. This will require system reset by cycling power. Shut if off and wait till LCD is dark. Restart the unit.

Line 2: INPUT OK @ CHG ON

INPUT OK: Input within an acceptable range.

INPUT BAD: Input out of range.

CHRG ON: Charger on.

CHRG OFF: The charger is off. This will happen if the input capacitor is open or the system is in a failure mode. - UPS ALARM

Line 3: BATTERY OK @ DC OK

BATTERY OK: Battery voltage within an acceptable range.

BATTERY OV: Battery voltage high. This is normal when the battery is charging.

BATTERY LOW: Battery voltage low. Recharge battery.

DC OK: DC bus voltage within an acceptable range.

DC OV: DC bus voltage too high. - UPS ALARM

DC UV: DC bus voltage too low. - UPS ALARM

NOTE: The typical DC buss voltage should be higher than the battery voltage.

SCREEN B: The second default screen appears as below

```
OUTPUT:_____V @ _____ W
INPUT:  _____V @ _____ A
DC BUS: _____V @ NA A
BATT: _____V @ + _____ W
```

Line 1: Indicates output voltage and power in watts, when an output transformer is not used. It indicates primary voltage of the output transformer (T1) (208 VAC, typically) when T1 is used.

Line 2: Indicates input volts and Amps.

Line 3: Indicates internal DC bus condition for factory use.

Line 4: Indicates battery voltage. The (+) current in Amps indicates charging Amps, while (-) indicates discharging Amps.

SCREEN C: When an optional output transformer is installed, the multiple output voltages are displayed as follows:

```
OUTPUT: 120 V @
OUTPUT: 208 V @
OUTPUT: 277 V @
OUTPUT: 480 V @
```

Line 1: Indicates L-N output voltage 1

Line 2: Indicates L-N output voltage 2

Line 3: Indicates L-N output voltage 3

Line 4: Indicates L-N output voltage 4

Crucial Power Products

APPENDIX C – OPTIONAL MAIN INPUT & MAIN OUTPUT BREAKERS FOR VARIOUS MODELS.

STANDARD KAIC-1PH UPS **INPUT** CIRCUIT BREAKERS												
	120V INPUT			208V INPUT			240V INPUT			277V INPUT		
UNIT RATING	RATING/ KAIC	C/H P/N	P/N	RATING/ KAIC	C/H P/N	P/N	RATING/ KAIC	C/H P/N	P/N	RATING/ KAIC	C/H P/N	P/N
3 KW	1P, 50A, 14 KA	QC1050	2025-784	2P, 30A, 10 KA	QC2030H	2025-790	2P, 25A, 10 KA	QC2025H	2025-789	2P, 25A, 14 KA	GHC2025	2025-763
5 KW	2P, 80A, 10 KA	QC2080	2025-795	2P, 50A, 10 KA	QC2050H	2025-792	2P, 40A, 10 KA	QC2040H	2025-791	2P, 35A, 14 KA	GHC2035	2025-765
7.5 KW	1P, 100A, 14 KA	QC1100	2025-786	2P, 60A, 10 KA	QC2060H	2025-793	2P, 50A, 10 KA	QC2050H	2025-792	2P, 50A, 14 KA	GHC2050	2025-767
10 KW	2P, 150A, 65 KA	ED2150L	2025-760	2P, 90A, 10 KA	QC2090H	2025-796	2P, 70A, 10 KA	QC2070H	2025-794	2P, 60A, 14 KA	GHC2060	2025-768
12.5 KW	2P, 175A, 65 KA	ED2175L	2025-999	2P, 100A, 10 KA	QC2100H	2025-797	2P, 90A, 10 KA	QC2090H	2025-796	2P, 80A, 14 KA	GHC2080	2025-770
15.0 KW	2P, 200A, 65 KA	ED2500L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65 KA	ED2125L	2025-759	2P, 100A, 14 KA	GHC2100	2025-772
20KVA/14 KW	2P, 200A, 65 KA	ED2500L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65 KA	ED2125L	2025-759	2P, 100A, 14 KA	GHC2100	2025-772
20KVA/17 KW	2P, 200A, 65 KA	ED2500L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65 KA	ED2125L	2025-759	2P, 100A, 14 KA	GHC2100	2025-772

HIGHER KAIC-1 PH UPS **INPUT** CIRCUIT BREAKERS												
	120V INPUT			208V INPUT			240V INPUT			277V INPUT		
UNIT RATING	RATING/	C/H P/N	P/N	RATING/	C/H P/N	P/N	RATING/	C/H P/N	P/N	RATING/	C/H P/N	P/N
3 KW	1P, 50A, 42 KA	QHCX1050	2025-800	2P, 30A, 65 KA	GHC2030	2025-764	2P, 25A, 65 KA	GHC2025	2025-763	2P, 25A, 65 KA	HFD2025L	2025-775
5 KW	2P, 80A, 42 KA	QHCX2080	2025-802	2P, 50A, 65 KA	GHC2050	2025-767	2P, 40A, 65 KA	GHC2040	2025-766	2P, 35A, 65 KA	HFD2035L	2025-776
7.5 KW	2P, 100A, 65 KA	GHC2100	2025-772	2P, 60A, 65 KA	GHC2060	2025-768	2P, 50A, 65 KA	GHC2050	2025-767	2P, 50A, 65 KA	HFD2050L	2025-777
10.0 KW	2P, 150A, 65 KA	ED2150L	2025-760	2P, 90A, 65 KA	GHC2090	2025-771	2P, 70A, 65 KA	GHC2070	2025-769	2P, 60A, 65 KA	HFD2060L	2025-778
12.5 KW	2P, 175A, 65 KA	ED2175L	2025-999	2P, 100A, 42 KA	GHC2100	2025-772	2P, 90A, 65 KA	GHC2090	2025-771	2P, 80A, 65 KA	HFD2080L	2025-780
15.0 KW	2P, 200A, 65 KA	ED2200L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65 KA	ED2125L	2025-759	2P, 100A, 65 KA	HFD2100L	2025-1007
20KVA/14 KW	2P, 200A, 65 KA	ED2200L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65KA	ED2125L	2025-759	2P, 100A, 65 KA	HFD2100L	2025-1007
20KVA/17 KW	2P, 200A, 65 KA	ED2200L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65 KA	ED2125L	2025-759	2P, 100A, 65 KA	HFD2100L	2025-1007

HB 101 REV X3

Crucial Power Products

STANDARD KAIC-1PH UPS **OUTPUT** CIRCUIT BREAKERS

	120V OUTPUT			208V OUTPUT			240V & 240/120V OUTPUT			480V/277V OUTPUT		
UNIT RATING	RATING/ KAIC	C/H P/N	P/N	RATING/ KAIC	C/H P/N	P/N	RATING/ KAIC	C/H P/N	P/N	RATING/ KAIC	C/H P/N	P/N
3 KVA/3 KW	1P, 30A, 14 KA	QC1030	2025-782	2P, 20A, 10 KA	QC2020H	2025-788	2P, 15A, 10 KA	QC2015H	2025-787	2P, 15A, 14 KA	GHC2015	2025-761
5 KVA/5 KW	1P, 50A, 14 KA	QC1050	2025-784	2P, 30A, 10 KA	QC2030H	2025-790	2P, 25A, 10 KA	QC2025H	2025-789	2P, 25A, 14 KA	GHC2025	2025-763
7.5KVA/7.5 KW	2P, 80A, 10 KA	QC2080	2025-795	2P, 50A, 10 KA	QC2050H	2025-792	2P, 40A, 10 KA	QC2040H	2025-791	2P, 35A, 14 KA	GHC2035	2025-765
10KVA/10 KW	1P, 100A, 14 KA	QC1100	2025-786	2P, 60A, 10 KA	QC2060H	2025-793	2P, 50A, 10 KA	QC2050H	2025-792	2P, 50A, 14 KA	GHC2050	2025-767
12.5KVA/12.5 KW	2P, 125A, 65 KA	ED2135L	2025-759	2P, 80A, 10 KA	QC2080H	2025-795	2P, 70A, 10 KA	QC2070H	2025-794	2P, 60A, 14 KA	GHC2060	2025-768
15.0KVA/15.0 KW	2P, 150A, 65 KA	ED2150L	2025-760	2P, 90A, 10 KA	QC2090H	2025-796	2P, 80A, 10 KA	QC2080H	2025-795	2P, 70A, 14 KA	GHC2070	2025-769
20.0 KVA (14KW	2P, 200A, 65 KA	ED2200L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65 KA	ED2125L	2025-759	2P, 100A, 14 KA	GHC2100	2025-772
20.0 KVA (17 KW	2P, 200A, 65 KA	ED2200L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65 KA	ED2125L	2025-759	2P, 100A, 14 KA	GHC2100	2025-772

HIGHER KAIC-1 PH UPS **OUTPUT** CIRCUIT BREAKERS

	120V OUTPUT			208V OUTPUT / 480V			240V & 240/120V OUTPUT			277V OUTPUT		
UNIT RATING	RATING/ KAIC	C/H P/N	P/N	RATING/ KAIC	C/H P/N	P/N	RATING/ KAIC	C/H P/N	P/N	RATING/ KAIC	C/H P/N	P/N
3 KVA/3 KW	1P, 30A, 65 KA	QHCX1030	2025-798	2P, 20A, 65 KA	GHC2020	2025-762	2P, 15A, 65 KA	GHC2015	2025-761	2P, 15A, 65 KA	HFD2015L	2025-773
5 KVA/5 KW	1P, 50A, 65 KA	QHCX1050	2025-800	2P, 30A, 65 KA	GHC2030	2025-764	2P, 25A, 65 KA	GHC2025	2025-763	2P, 25A, 65 KA	HFD2025L	2025-775
7.5KVA/7.5 KW	2P, 80A, 65 KA	QHCX2080	2025-802	2P, 50A, 65 KA	GHC2050	2025-767	2P, 40A, 65 KA	GHC2040	2025-766	2P, 35A, 65 KA	HFD2035L	2025-776
10KVA/10 KW	1P, 100A, 65 KA	QHCX2100	2025-803	2P, 60A, 65 KA	GHC2060	2025-768	2P, 50A, 65 KA	GHC2050	2025-767	2P, 50A, 65 KA	HFD2050L	2025-777
12.5KVA/12.5 KW	2P, 125A, 65 KA	ED2125L	2025-759	2P, 80A, 42 KA	GHC2080	2025-770	2P, 70A, 65 KA	GHC2070	2025-769	2P, 60A, 65 KA	HFD2060L	2025-778
15.0KVA/15.0 KW	2P, 150A, 65 KA	ED2150L	2025-760	2P, 90A, 65 KA	GHC2090	2025-771	2P, 80A, 165 KA	GHC2080	2025-770	2P, 70A, 65 KA	HFD2207L	2025-779
20.0 KVA (14KW	2P, 200A, 65 KA	ED2200L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65 KA	ED2125L	2025-759	2P, 100A, 65 KA	HFD2100L	2025-1007
20.0 KVA (17 KW	2P, 200A, 65 KA	ED2200L	2025-541	2P, 125A, 65 KA	ED2125L	2025-759	2P, 125A, 65 KA	ED2125L	2025-759	2P, 100A, 65 KA	HFD2100L	2025-1007

HB 101 REV X3

APPENDIX D - BATTERY CONNECTIONS

Caution

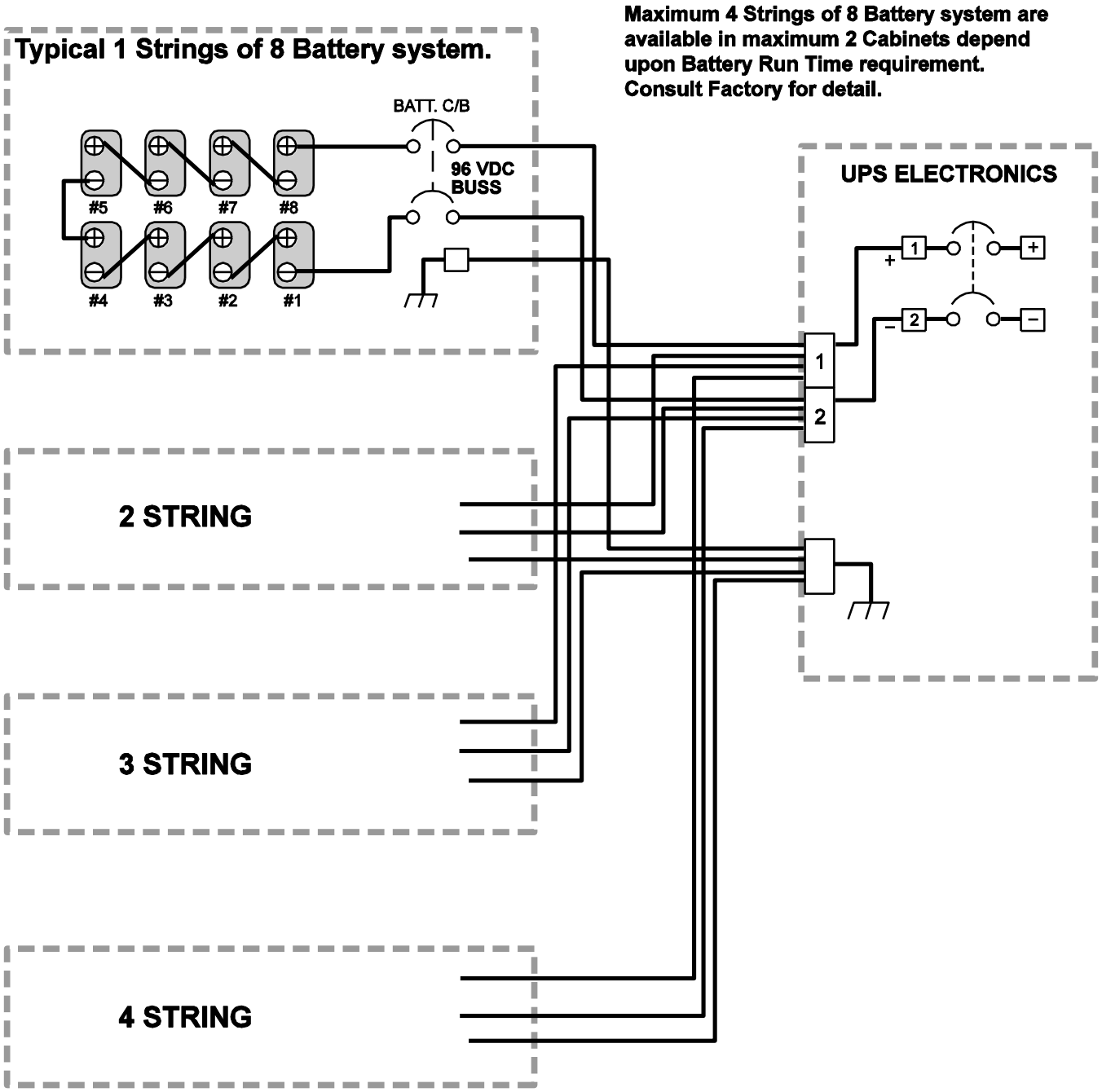
For the actual battery connection diagram for your system, refer to the diagram on each unit. The drawings below are shown for electrical connection only and do not necessarily match the actual battery' layout in your unit. The arrangement may be different from drawings.

Danger!

The use of a physically damaged battery can cause a catastrophic system failure and can even result in a fire or explosion that could endanger life and property. Before accepting a battery shipment from the carrier, please read and follow these instructions:

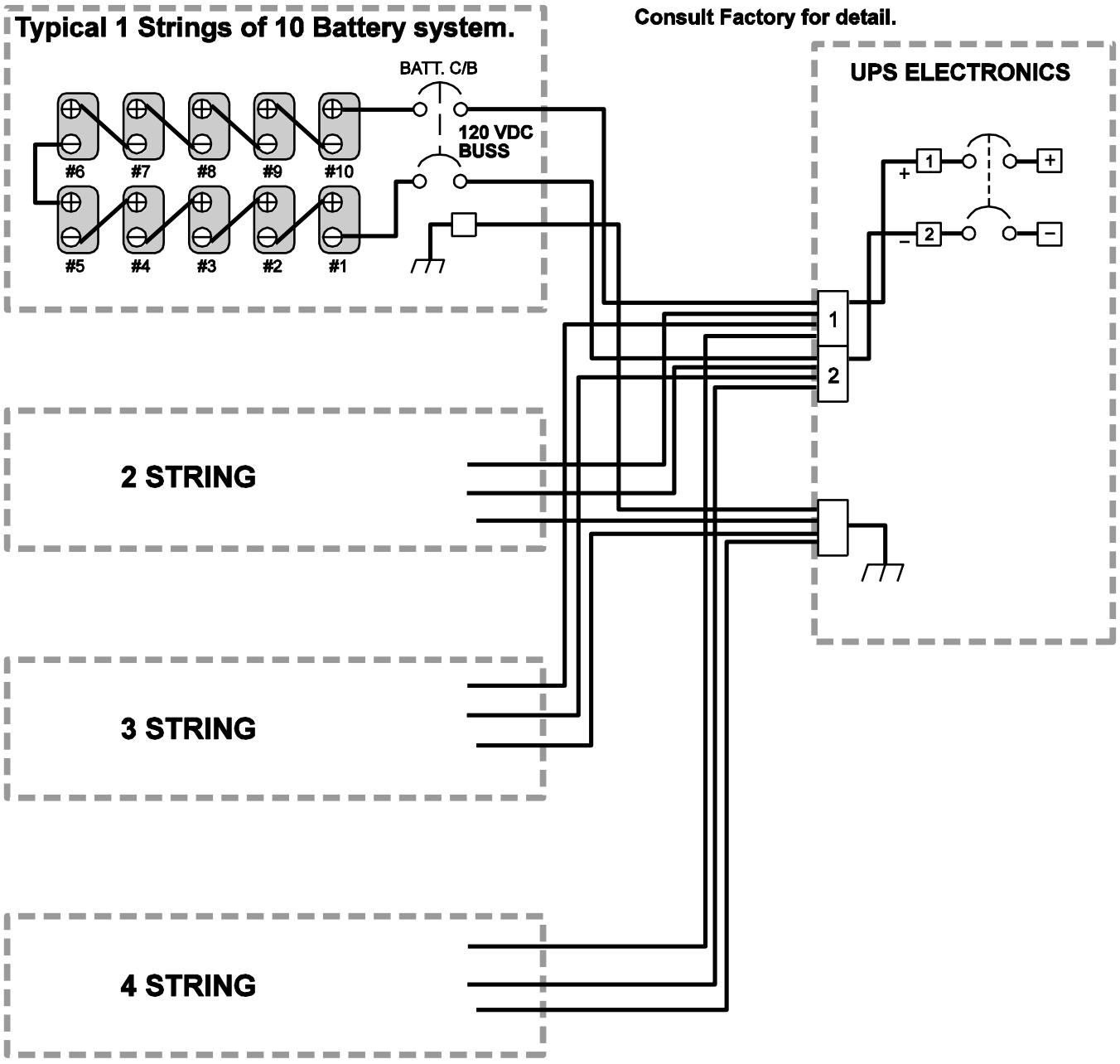
1. Thoroughly inspect each battery for any signs of damage. If there is any damage, reject the shipment and notify the manufacturer at 800-PWR-SRVC (800-797-7782). If possible, photograph the damage for future reference.
2. As you unpack the pallet or container, check each battery box for damage on all sides, the top and bottom. If there is any sign of damage, photograph the damage if possible, and contact Online Power at 800-PWR-SRVC (800-797-7782).
3. Before you install each battery in the cabinet, remove it from its carton and thoroughly inspect it again on every side, the top and bottom for any signs of physical damage including, but not limited to, cracks, chips, leaks, bulges, and so forth.
4. If battery is dropped or makes hard contact with any abject, inspect it again.
5. Batteries are heavy, so exercise care when lifting them to the shelves of a battery cabinet.
6. If at any time you have any questions regarding the condition of a battery, set it aside and notify the manufacturer at 800-PWR-SRVC (800-797-7782). **Do not use a questionable battery under any circumstances, even temporarily.**

96 Volt Nominal

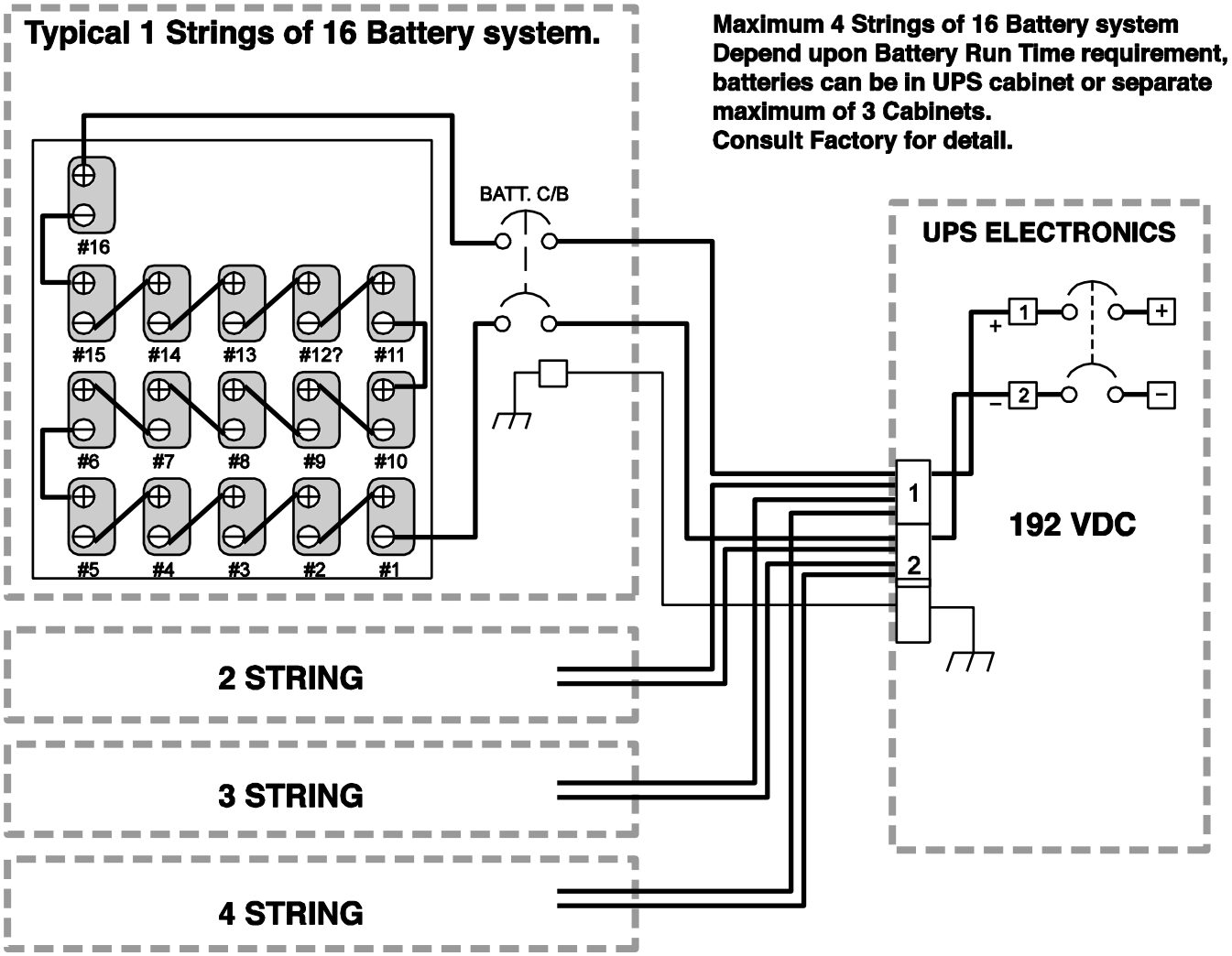


120 Volt Nominal

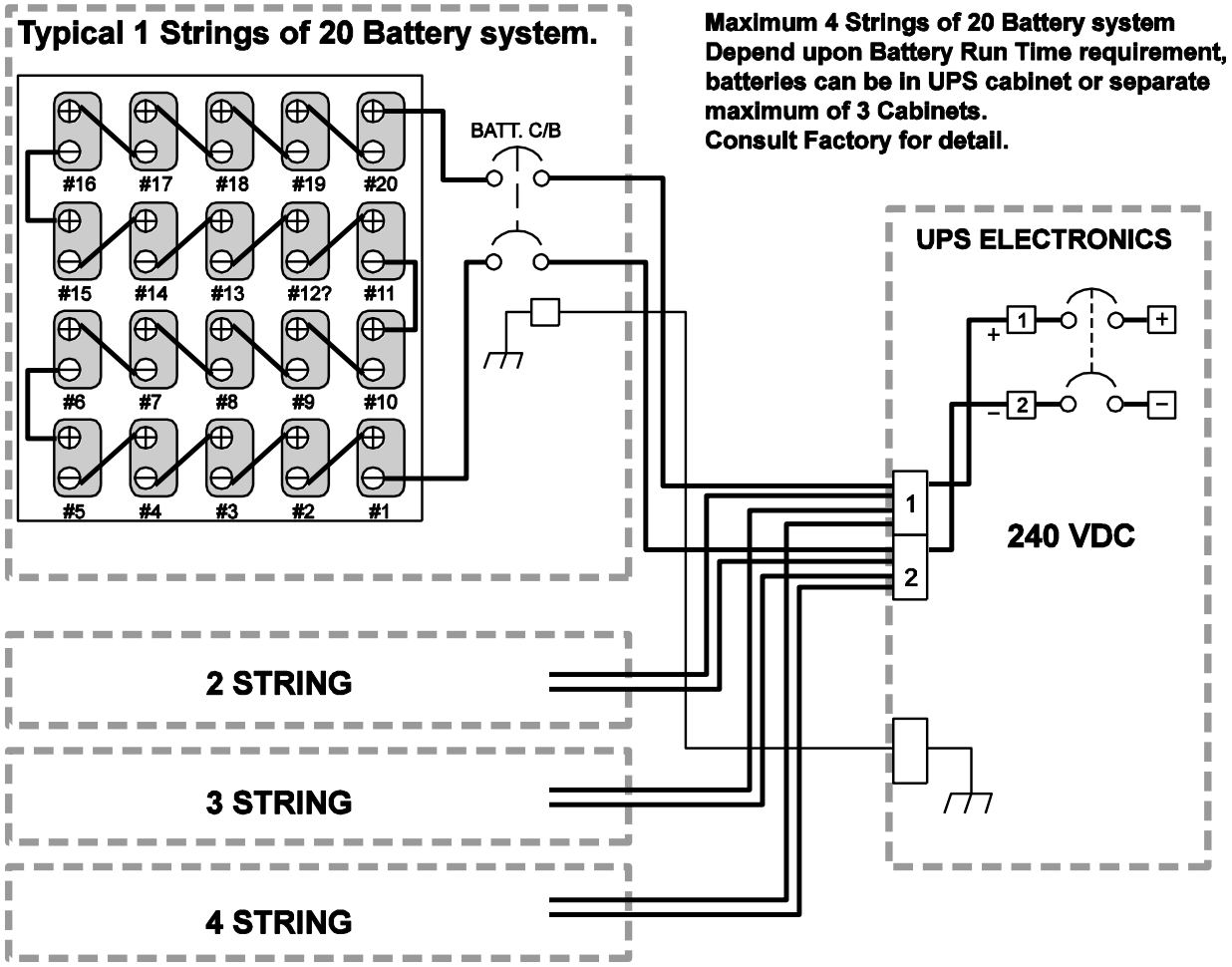
Maximum 4 Strings of 10 Battery system Depend upon Battery Run Time requirement, batteries can be in UPS cabinet or separate maximum of 2 Cabinets. Consult Factory for detail.



192 Volt Nominal



240 Volt Nominal



APPENDIX E – DRAWINGS FOR SINGLE PHASE UNIT

(All drawings are downloadable from Website: www.crucialpower.com)

1. Unit & Battery Cabinet Installations – 1 Phase UPS with 90 Min. Battery Backup 3, 5, 7.5, 10, 12.5, 15, and 20 kVA / 2.1, 3, 3.5, 5, 5.25, 7, 7.5, 8, 8.5, 10, 10.5, 14, 15, kW- 6001-033-01
2. UPS & Battery Cabinet Layout – 1 Phase UPS with 90 Min. Battery Backup 3, 5, 7.5, 10, 12.5, 15, and 20 kVA / 2.1, 3, 3.5, 5, 5.25, 7, 7.5, 8, 8.5, 10, 10.5, 14, 15, kW- 6001-033-02
3. 1 Phase UPS Functional Block Diagram – Single Line Diagram Dwg #: 6001-033-03
4. UPS & Battery Cabinet Seismic Certification Drawing – Dwg. 6002-1658 (09-0319-A)
5. Single Phase UPS with Load Center – Dwg # 6001-032-19.
6. Single Phase External Wrap around by-pass Panel: 3KVA TO 20 KVA Dwg. 6001-032-31 & 6001-032-31S

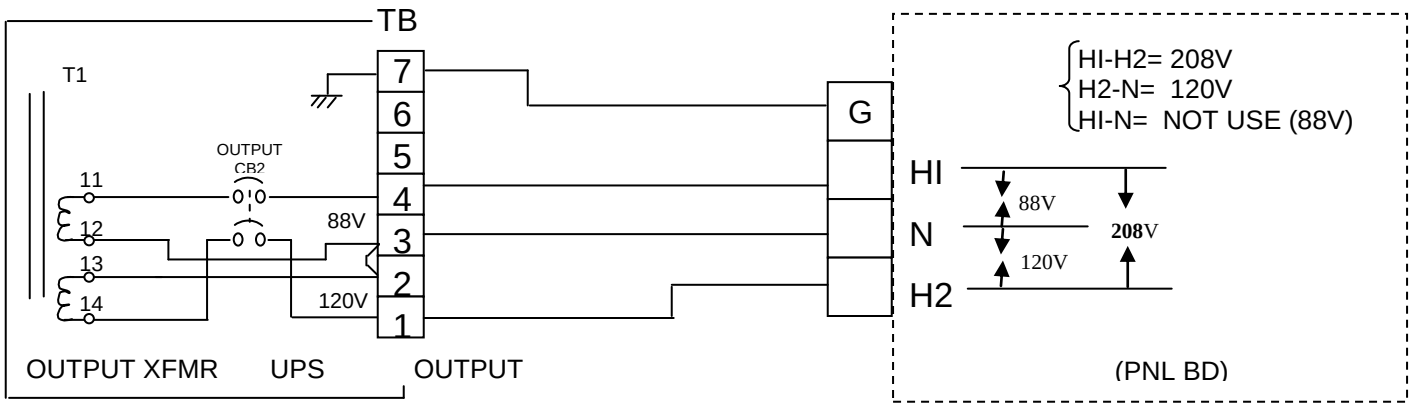
TABLES

1. Single Phase Unit Chart for recommended output/input protective device rating. BTU/HR and Floor Loading Table XXX-1 and XXX-2
2. Allowable Ampacities of Insulated Conductors Rated 0-2000 V, 60 to 90 deg. C, (140 – 194 deg. F). Table 310-16 of National Electrical Code.
3. Connection Type / Wire Size Range
4. Torque Specifications (Unless Otherwise Labeled)
5. Unit Installation Data
6. Specifications

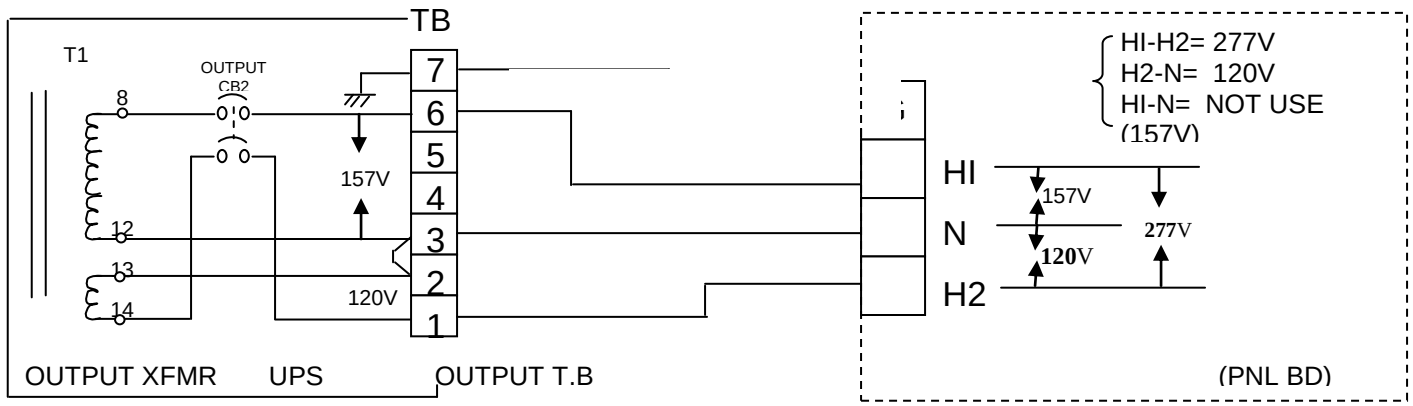
APPENDIX F

Connection Diagram using existing 3 pole panel board for dual output voltages.

A)



B)



C)